

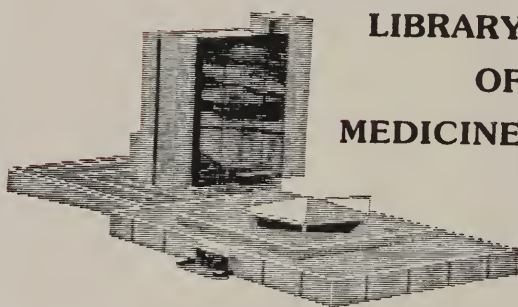
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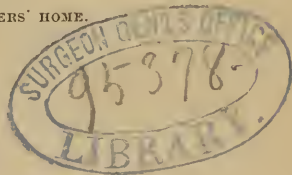


THE
MORTALITY
OF
SURGICAL OPERATIONS
IN THE
UPPER LAKE STATES,
COMPARED WITH
THAT OF OTHER REGIONS.

By EDMUND ANDREWS, A. M., M. D.,
PROFESSOR OF PRINCIPLES AND PRACTICE OF SURGERY IN CHICAGO MEDICAL COLLEGE.

ASSISTED

By THOMAS B. LACEY, M. D.,
ASSISTANT SURGEON IN THE NATIONAL SOLDIERS' HOME.



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PREFACE.

The preparation of this paper, which is reprinted from the *Chicago Medical Journal and Examiner*, has been a work of immense labor. My plan has been to compare the results of each surgical operation in the Lake States with the same in other regions. To obtain the statistics of the latter a wide array of surgical literature had to be consulted, in several languages, and at a great expenditure of time. After comparing the statistical results of any given operation, both at home and abroad, I have collected and appended the opinions of the chief surgical authorities of both continents as to the cases suited to its performance, and added my own reasons and conclusions to theirs. The surgeon therefore can obtain at a glance the results of any operation, both here and elsewhere, and with them the opinions of the principal authors respecting it.

All surgeons have felt the need of such a condensed view of operative surgery, yet there is not in the English language a single work supplying the want.

I trust that this humble beginning, imperfect as it is, may furnish the means of settling many questions for the practitioner who is debating with deep anxiety the propriety of a proposed operation, and can find no decisive information in his standard text books.

No. 6 Sixteenth St., Chicago, Ill.

E. A.

THE MORTALITY OF SURGICAL OPERATIONS

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ASSISTED BY THOS. B. LACEY, M.D.,

ASSISTANT SURGEON IN THE NATIONAL SOLDIERS' HOME.

Operative Surgery in the Lake States of America has results widely different from those of the Atlantic region, and of Europe. Many operations are much less fatal here than there, so that to the most important of all questions about a proposed operation, viz., What is its danger? the Western practitioner can find no book to furnish him a correct answer. Full proof of this will be given as we proceed.

The object of the present essay is to assist the Western surgeon in ascertaining with regard to the principal operations :

1. What is their risk in the Lake States ?
2. What has it been in other regions ?
3. What are the opinions and precepts of the principal surgeons of the world regarding each ?
4. What conclusions are we to draw for our own guidance ?

Before entering upon details, we may illustrate the wide difference between the results of our surgery and that of other regions by studying the following condensed table :

TABLE I.

Showing the Mortality of the Four Major Amputations in the Lake States, compared with the same operations elsewhere. (Joint amputations excluded.)

	ARM.			FOREARM.			THIGH.			LEG.			All Combined.		
	Cases.	Died.	Pr ct.	Cases.	Died.	Pr ct.	Cases.	Died.	Pr ct.	Cases.	Died.	Pr ct.	Cases.	Died.	Pr ct.
Lake States, H.-s.p. and Priv. Prac. combined, with cases not stated, whether hospital or not.....	27	8	11	20	2	10	76	18	24	70	16	23	193	39	20
Lake States, Hospital Practice alone.....	10	1	10	9	1	11	20	6	30	28	5	18	67	13	19
Lake States, Private Practice alone.....	16	1	6	11	1	9	54	11	20	41	10	24	122	23	19
Pennsylvania Hospital.....	71	9	13	100	9	76	25	33	138	54	38	385	97	25	32
New York.....	21	1	5	20	5	25	51	24	47	44	13	30	136	43	38
Boston City.*	27	10	37	17	2	12	41	22	54	34	11	32	119	45	35
Moscow, General.....	76	14	18	68	13	19	236	68	29	267	66	25	647	161	25
British Hospitals in general.....	297	110	37	244	40	16	935	435	46	613	270	44	2,089	855	41
Country Hospitals.....	374	67	18	375	32	8	925	256	28	838	177	21	2,512	532	21
Priv. Prac. Simpson's erroneous statis.....	433	19	4	378	2	5	669	123	18	618	82	13	2,048	226	10
Parisian Hospitals*.....	35	19	54	33	11	33	119	80	67	113	71	63	300	181	60
K. k. allg. Krankenhaus, Vienna**.....	72	23	32	73	21	29	157	81	51	241	71	29	543	196	36

* Reports of Boston City Hospital.

+ Boston Medical and Surgical Journal. May 1, 1872.

+ Works of Sir J. Y. Simpson, p. 338.

§ Mr. Callender. in St. Bartholomew's Hospital Report. 1869

|| Works of Sir J. Y. Simpson, p. 304.

• Statist. des Hôpitaux de Paris, 1861—63.

** Aertzlicher Bericht, k. k. allgemeinen Krankenhäuser, Wien, 1861—71.

The first thing which strikes the Western surgeon in this table, is the prodigious excess of mortality reported almost everywhere. With us the average mortality of all the four major amputations combined, is only 20 per cent., while in the hospitals of the Atlantic States it is 30 per cent.; in the great Imperial General Hospital (k. k. allg. Krankenhaus) of Vienna, 36 per cent., in the British hospitals, 41 per cent., and in the famous hospitals of Paris, it attains the astounding figure of 60 per cent.

Yet these rates of mortality are not inevitable results in each region, for if we examine more closely, we find that the British country hospitals have a mortality but little greater than those of Chicago.

I pass over, for the present, the strange figures of Sir J. Y. Simpson about British private practice, which show an apparent mortality for the four major amputations, of only 10 per cent. The error of these figures has been exposed by Callender and others, and the curious way in which it occurred will be hereafter explained.

Again, if we take the important operation of herniotomy, we find a perfectly similar result, as we may see from the following figures :

TABLE II.

Showing the Mortality of Herniotomy, in the Lake States, compared with that of other Regions.

	CASES.	DEATHS.	PER CT. MORT.
Lake States	34	8	24
Vienna General Hospital	259	114	44
London Hospitals	326	136	42
British larger Provincial Hospitals	177	72	41
" smaller "	118	53	45
Paris Hospitals	361	244	68
Combined Hospital and Private Practice in Boston, Cheever	27	14	52

It thus appears that the very hospitals and great masters to which we have resorted most for instruction in surgery have the least success in curing their patients. It follows also, that as operative risks with us thus differ greatly from the rates generally given at the East, we shall be compelled to revise all the estimates, and deduce new rules adapted to the facts of our own region. It is in the hope to contribute something to this great end, that the following facts and figures have been laboriously collected.

It will be remarked by referring to Table I, that there is but little difference in the Lake States between the results of private and of hospital practice, and, I may also add, between country and city practice. Here are the figures, fractions being omitted :

Mort. of the 4 maj. amp's in Lake States Hospitals.....	19 per ct.
“ “ “ private practice in the Lake States	19 “
“ “ “ country “ “	20 “

In contrast to this approximate uniformity, Sir J. Y. Simpson represents the mortality of hospital major amputations in Great Britain to be four times as great as in private country practice, viz. :

British civil hospital mortality.....	41 per cent.
“ private country practice mortality.....	11 “

Two things here surprise the Western American surgeon :

1. That the difference between the hospital and private practice is so enormous—

2. That country amputations in Great Britain should be twice as successful as among the vigorous, well-fed population around our great lakes.

This last point requires consideration, and certainly looks like an error, for our country people are robust, well fed, and well housed, probably more so than the British peasantry. It cannot be the difference in skill, for though the average American grade of professional education is lamentably low, yet the country surgeons, from whom I collected these cases were picked men, all known to me to be men of education, and generally of superior capacity. Taking them together, I pronounce them, without hesitation, to be fully equal to country surgeons in Great Britain.

After careful reflection, I think that Sir J. Y. Simpson's country statistics are grossly delusive, and that he in all honesty has fallen into a fatal error in the manner of collecting his cases. I wish to dwell upon this a little, because the same identical blunder is repeated every year by committees of medical societies, desirous of collecting surgical statistics for their reports.

Sir J. Y. Simpson printed a quantity of blank reports of amputations to be filled out with the operations and their results, and mailed these to an immense number of country surgeons, most of whom must have been personally unknown to him. Now, in the replies thus

obtained, there will be three sources of error, all tending to understate the deaths and exaggerate the proportion of recoveries.

1. Those surgeons who are honest, but have chanced to have a "run of bad luck," that is, an accidental series of incurable cases, will not be likely to answer the circular. They are chagrined at the results of their efforts, and indisposed to court publicity for them. To a large extent these men will neglect to reply, and their fatal cases will be lost to the collector.

2. For analogous reasons the honest surgeon, who has had accidentally a "run" of favorable cases, feels exhilarated, and quite desirous to have them brought to notice. Such men will all respond, and thus give a preponderance of successful cases.

3. The dishonest men, (and there are perhaps some liars in Great Britain, as well as elsewhere) look upon the circular as a favorable opportunity to bring themselves into the notice, at least of Sir James, and perhaps of the rest of the world, if he should chance to publish names. They will therefore fill up the paper with false cases, or true cases with false results, or deceive more gracefully by omitting their fatal cases.

It is inevitable that statistics gathered by promiscuous circulars must be grossly delusive, and they always falsify on the successful side.

Impressed with the necessity of avoiding this error, I only applied to men of known and high-toned honesty, and almost always made my application in such a way as to secure a positive response. In this way the number of cases collected was much smaller than that obtained by Simpson, but they are truthful, and, I believe, represent correctly the results of operative surgery in this region.

If this correction could be made in Sir James' tables, I think the results of British private practice would not differ greatly from the American.

There is another mode of collecting statistics equally absurd which it may be worth while to mention here,

This consists in searching the files of medical journals and picking up and tabulating the operations there recorded. The notorious fact that men for the most part go into print with only successful cases, is sufficient to show the utter worthlessness of such figures.

I have not entered upon the old dispute whether statistics are of any use. Fifteen years ago the principal English surgeons were accustomed either to scout them openly, or, when they employed them, entered a protest that they attached little weight to them. At the present time, the whole surgical world is agreed, that properly collected, they are important aids in arriving at truth.

The fact is, statistics are simply recorded experience, and cannot be ignored, any more than experience in any other form. They have the same liability to error as other methods of investigation, viz., that they may be unskillfully or dishonestly managed, and fail to reach the truth; but the same must be said of all other modes of recording experience. No sane man will pin his faith to statistics alone, but all surgeons at the present day recognize them as important aids, in our methods of research.

The cases in this essay are derived—

1. From the surgical records of Mercy Hospital, which have been carefully preserved under my own supervision since June, 1859.

2. From records of my private practice.

3. From such partial records of operations in the Marine, the County, St. Luke's and the two Women's Hospitals, as survived the great fire.

4. Notes of the operations of surgeons in Chicago and in the surrounding country, who are personally known to me, and whose statements I believe can be relied on for candor and truth.

As I desire that these statistics shall be worthy of the highest confidence. I have carefully rejected from the Lake States lists all matter furnished by persons not known to be trustworthy, as well as all tables of cases, published in journals or in reports of societies,

whose mode of compilation was not fully known to me. The tables of Western practice here given, embody with absolute impartiality the failures as well as the successes of the operators, so that they may be trusted as fair samples of the operative work of this region.

In collating, for comparison with ours, the printed statistics of other regions, I have, so far as possible, rejected all figures collected by the faulty methods above referred to, but it is impossible to determine the faithfulness and honesty of distant authors with the same precision that we can that of our own acquaintances.

All military cases are omitted from the tables of Lake States surgery, but are often quoted for comparison in stating results elsewhere. There are several excellent surgeons in Chicago, such as Professors Freer, Gunn, Isham, Sherman, Powell and Bogue, who were unable to furnish me more than a very few cases, notwithstanding their extensive experience, partly because they lost all their papers in the great fire, which swept the city, and partly because the hospitals, in which they served, lost their books in the same tremendous conflagration. Otherwise the tables might have been more extensive, though the ratios of mortality would not have been materially changed.

The hospital cases are almost entirely derived from the records of Mercy Hospital, and it is worthy of notice that, contrary to the experience elsewhere, their results have equaled those of private practice. I attribute this good fortune mainly to the special care which I have given to ventilation and other antiseptic measures.

AMPUTATIONS.

First among these we will consider the disarticulations of the shoulder joint, of which very few have occurred in this city. In my own practice, I have uniformly preferred excision of the joint wherever the choice was possible, because it is not only less dangerous but leaves a very useful limb.

TABLE III.

Amputations at the Shoulder Joint.

OPERATOR.	AGE.	REASON FOR OPERATION.	COMPLICATIONS.	OPERATION.	GENERAL CONDITION AT TIME OF OPERATION.	TIME FROM BEGINNING OF CASE TO OPERATION.	TIME FROM OPERATION TO DEATH OR RECOVERY.	RESULT.	HOSPITAL OR PRIV. PRACTICE.
Dr. E. Andrews.....		Comp. fract. humerus from R. R. cars.....		Tissues of chest torn Flap.		Primary.	42 days.	Recovered.	Hospital.
" A. Fisher.....	30 yrs.	Gunshot fracture at joint.....			Medlum.	7 days.		"	"
" Hooper.....	32 "	R. R. fracture humerus.....	None.....		Good.	8 "	36 hrs.	Died +	"
" J. H. Hollister.....	24 "	Caries of humerus after ampt. at mid. 3d.....	None.....		Bad.			Recovered.	Priv. Prac.
Cook Co. Hospital*		Disease of parts.....						Died.	Hospital
Dr. A. J. Baxter.....	36 "	Necrosis after fract. humerus.....	None.....		Bad.	6 weeks.		"	Priv. Prac.
" A. J. Baxter.....	25 "	Compound fract. humerus.....	None.....		Good.	Primary.		Recovered.	"
" A. J. Baxter.....	35 "	Compound fract. shoulder.....	None.....		Medium.	"		"	"
" A. J. Baxter.....		Necrosis of humerus after ampt. of arm.....	None.....		"	6 months		"	"
" A. J. Baxter.....		Compound fract. of humerus.....			"	Primary.		"	"
" E. W. Lee.....	50 "	Compound fract. of humerus.....			Bad.		4 weeks	"	"
" E. W. Lee.....	45 "	Compound fracture of humerus.....		Flap.	"	Primary.	5 "	"	"
" S. Marks.....	34 "	Traumat. aneurism of subclavian artery.....			Medium.	8 weeks.	4 "	"	Hospital.

* Surgeon's name not recorded.

+ Cause of death, pyemia.

Total, 13 cases.

RECAPITULATION—Recovered, 10, of which 5 were primary, 2 secondary, 1 pathological, and 2 not stated.

Died, 3, of which 2 were secondary, and 1 pathological.

Hospital practice, 5 cases, of which 2 died.

General mortality, 23 per cent.

Private practice, 8 cases, of which 1 died.

DISARTICULATIONS OF THE SHOULDER ABROAD.

I find the following records of this operation in various countries :

TRAUMATIC PRIMARY CASES.

AUTHORITIES.	CASES.	DEATHS.
Med. Hist. War of Rebellion, Part II, Surg. Vol., p. 614.	485	117
New York Hospital, Boston Med. Jour., 1872.	7	4
Boston City Hosp. Rept., Dr. Cheever.	9	7
Mass. Gen. Hosp., 1871.	15	8
Penn. Hosp., Dr. Norris.	11	2
U. S. Marine Hosp. Repts., Dr. Woodworth.	1	1
St. Thomas Hosp. Rept., London.	2	1
St. Bartholomew's Hosp., London, Mr. Callender.	2	0
St. George's Hosp., London.	3	3
K. k. allg. Krankenhaus, Wien.	8	4
Dr. Herrgalt, Strasburg.	1	1
Leeds Gen. Infirmary, Mr. Nunnely.	9	4
Glasgow Infirmary, Glasgow Med. Jour., 1854.	19	8
Siege of Antwerp, Schmidt's Jahrbücher, vol. 156, p. 249.	5	0
Paris, 1830—32—48, " " " "	2	1
Crimean War, " " " "	172	105
Italian " " " "	12	5
British Mil. Hosp., Brussels, 1815, Guthrie's Com.	6	1
Schleswig Holstein War, Schmidt's Jahrbücher, vol. 156.	6	3
War of 1866, " " " "	2	0
Battles of Vittoria, Pyrenees and St. Sebastian, Guthrie, quoted in Dict. des Sci. Med., Art. Amputations.	19	1
Totals.	796	276

Mortality, 35 per cen'.

TRAUMATIC SECONDARY CASES.

	CASES.	DEATHS.
Med Hist. War of Rebellion, Part II, Surg. Vol., p. 614.	223	91
New York Hosp., Boston Med. Jour., 1872.	4	2
Boston City Hosp. Rept., Dr. Cheever.	2	1
Billroth's Letters.	1	0
Dr. Herrgalt, Strasburg.	1	1
Battles of Vittoria, Pyrenees, and St. Sebastian, Guthrie, quoted in Dict. des Sci. Med., Art. Amputations.	19	15
Glasgow Infirmary, Glasgow Med. Jour., 1854.	7	4
Siege of Antwerp. Schmidt's Jahrbücher, vol. 156.	3	2
Paris, 1830—32—48, " " " "	2	1
Crimean War, " " " "	56	35
Italian War, " " " "	34	16
Schleswig Holstein War, " " " "	4	3
War of 1866, " " " "	9	3
Dutch and German War, " " " "	4	1
British Mil. Hosp. in Brussels, 1815, Guthrie's Com.	12	6
Totals.	381	181

Mortality, 48 per cent.

PATHOLOGICAL CASES.

AUTHORITIES.	CASES.	DEATHS.
New York Hospital, Boston Medical Journal, 1872-----	2	1
Boston City Hospital, reported by Dr. Cheever-----	1	0
Massachusetts Gen. Hosp., Boston Medical Jour., 1872-----	11	3
Pennsylvania Hospital, " " " "-----	1	0
Guy's Hospital Reports-----	1	1
St. Thomas' Hospital Reports-----	1	0
St. Bartholomew's Hospital Reports, 1863-71-----	5	0
Statist. des Hôp. de Paris, 1861-63-----	6	3
Archiv. Klin. Chir., Bd. 8 and 10-----	4	1
Leeds General Infirmary, Mr. Nunnely-----	2	1
Totals-----	34	10

Mortality, 29 per cent.

SUMMARY OF SHOULDER AMPUTATIONS ABROAD.

	CASES.	DEATHS.	PER CENT. MORTALITY.
Traumatic, primary-----	796	276	35
" secondary-----	381	181	48
Pathological-----	34	10	29
Totals-----	1,177	457	39

Mortality in the Lake States, 23 per cent.

All traumatic operations of the group commonly called secondary, ought properly to be distributed after the military manner into *intermediary*, or those performed during the acute inflammation which precedes the setting up of free suppuration, and the true *secondary*, which includes all after the intermediary. Unfortunately the literature of surgery has not applied this important distinction to civil practice, and rarely to military. In Part II, Surg. Vol., p. 614, of the Medical and Surgical History of the War of the Rebellion, the American cases are thus divided, giving—

	CASES.	DEATHS.	PER CT. MORT.
Intermediary-----	157	72	46
True secondary-----	66	19	29

From these figures it appears that the mortality of this operation abroad averages 39 per cent., which is nearly twice that observed in the Lake States.

The primary amputations are a little less fatal than the secondary, but pathological cases are everywhere the safest, being only 29 per cent. abroad, and in the Lake States still less.

All the shoulder amputations are more fatal than resection, hence amputation should only be performed when resection is inadmissible. We shall discuss the relative dangers more fully when we come to treat of resections. At present it suffices to say that the operation is not justifiable for such cases as mere caries, compound fracture of the joint, etc., etc., for which it is occasionally performed.

OPINIONS OF AUTHORS.

Demme's statistics show that for gunshot fractures of the shoulder, excision gives the best, and conservative treatment the worst, results.

Dr. A. Kadis (Petersburg Med. Paper, 1869) says resection gives the best results, and disarticulation should be used only in the worst, and conservative treatment in the lightest cases; excision to be employed when the bone is comminuted and likely to become carious.

Joseph Lister says (Holmes' Surg., vol. V, p. 637): "Amputation at the shoulder-joint * * * yields very satisfactory results."

T. Holmes says (Holmes' Surg., vol. V, p. 664) amputation is only to be performed for injuries of the shoulder too extensive for excision, but is to be preferred for rapidly growing tumor of the head of the bone, especially if cancerous, but never for ankylosis.

Gant's Surgery, p. 289, says that in bullet wounds of the shoulder, amputation is not equal to excision; p. 454, speaking of compound fractures of the head of the humerus, that "amputation must be resorted to in any additional injuries to the vessels and nerves:" p. 673,

says amputation is less favorable than excision by about 6 per cent.

Guthrie advocated amputation at the shoulder for gunshot fractures of the upper part of the shaft of the humerus.

Erichsen (Surgery, vol. I, p. 203) advises to resect such cases, unless important vessels and nerves are destroyed also.

Ashurst (p. 117) says the results of this amputation are "tolerably favorable."

Otis, of the U. S. Army (Med. and Surg. Hist. of the War of the Rebellion, Surg. Vol., Part II, p. 664), advises expectant treatment for slight wounds of the joint, excision for severer ones, and amputation only for those whose nature renders the preservation of the limb too hopeless.

CONCLUSIONS.

1. Amputation at the shoulder in the Lake States has a mortality only a little over half that stated in the books.

2. It may be practiced when the parts below are so destroyed by violence or invaded by cancer as to admit of no more distal operation.

3. It should not be practiced for caries, for gunshot fractures not involving the great vessels and nerves, nor for any other condition which admits of resection.

TABLE IV.
Amputations of the Arm.

OPERATOR.	AGE. Yrs.	REASON FOR OPERATION.	COMPLICATIONS.	OPERATION.	(X-RAY) CONDITION OF THE OPERATION.	Time from beginning of operation.	RESULT.	Time from operation to death or recovery.	HOSPITAL OR PRIV. PRACTICE.
Dr. B. Andrews	...	Arm crushed by cars.	...	Middle 3d. Both arms at 2 & 6 in. below shoulder	...	Primary.	Recovered	28 days.	Hospital.
" E. Andrews	...	Arm crushed by machinery.	...	Middle 3d.	...	"	"	"	Priv. Prac.
" E. Andrews	...	Gunshot fract. of arm.	...	Flap, upper 3d.	...	Not stand	"	"	"
" E. Andrews	7	Arm crushed by cars.	Leg crushed.	Re-ampt. 1d. 3d.	...	Primary.	Died.	48 hrs.	Hospital.
" E. Andrews	25	Necrosis of stump of humerus.	None	Upper 3d.	...	15 mos.	Recovered	50 days.	Priv. Prac.
" E. Andrews	25	Ununited fract. from gunshot wound.	None	Upper 3d.	Good.	2 years.	"	4 mos.	Hospital.
" E. Andrews	36	Arm lacerated by machinery.	None	"	Med.	Primary.	"	"	"
" E. Andrews*	24	Cancer of stump.	None	"	"	Primary.	"	"	"
" E. Andrews†	25	Arm torn off by machinery.	None	Circ., upper 3d.	Bad.	Primary.	"	"	"
" E. Andrews	70	Cancer.	None	Upper 3d.	Good.	Primary.	"	"	Priv. Prac.
" La Count	45	Forearm torn off by machinery.	None	Circ., middle 3d.	"	Second y.	"	"	"
" La Count	45	Mortification of forearm after fract.	Abscess in arm.	Flap, upper 3d.	"	Primary.	"	"	"
" La Count	25	Forearm torn off at elbow by machinery.	None	"	"	"	"	"	Hospital.
Cook Co. Hospital	...	Injury.	...	Upper 3d.	...	Second y.	"	"	"
Cook Co. Hospital	12	Compound fract. forearm.	Tight band. and mort.	"	Bad.	3 days.	"	5 weeks	Priv. Prac.
Dr. H. Wardner	12	Arm crushed by R. R.	Chest injured severely	Lower 3d.	"	Primary.	Died. ‡	3 days.	"
" H. Wardner	13	Compound fract. elbow.	Erysipelas & gangrene	Upper 3d.	"	11 mos.	Recovered	4 weeks	"
" E. D. Kitroe	14	Necrosis bone of arm and forearm	None	Middle 3d.	"	Second y.	"	"	"
" E. D. Kitroe	24	Member mortified by tight binding	"	Upper 3d.	Good.	Primary.	"	"	"
" E. D. Kitroe	23	Gunshot wound of elbow and arm.	Great shock.	Flap, upper 3d.	"	"	"	3 weeks	"
" E. W. Lee	10	Compound fract. humerus.	"	"	Med.	"	"	4 "	"
" E. W. Lee	20	Compound fract. humerus.	"	Upper 3d.	"	10 days.	"	"	Hospital.
" S. Marks	26	Traumatic gangrene.	"	Lower 3d.	Bad.	20 hours.	Died.	"	"
" S. Marks	21	Compound fract. humerus	Tetanus.	Upper 3d.	Good.	Primary.	Recovered	6 weeks	Priv. Prac.
" S. Marks	30	Compound fract. humerus.	"	Lower 3d.	"	"	"	"	"
" S. Marks	5	Compound fract. humerus.	"	Upper 3d.	"	"	"	18 days.	"

* No. in Andrews' Surgical Record, 8,399.

† No. in Andrews' Surgical Record, 8,421.

‡ Had tetanus 20 days.

§ Cause of death, gangrene.

RECAPITULATION.

	CASES.	DEATHS.	PER CENT. MORTALITY.
Total Number.....	27	3	11
Traumatic, primary.....	15	3	20
“ secondary.....	8	0	0
Time of operation not stated.....	1	0	0
Pathological.....	3	0	0
Hospital Cases.....	10	1	10
Private Practice.....	16	1	6

AMPUTATION OF THE ARM ABROAD.

The following figures give a fair view of the world's experience in this operation :

TRAUMATIC PRIMARY.

AUTHORITIES.	CASES.	DEATHS.
Med. Hist. War of Rebellion, Surg. Vol., Part II, p. 697..	3,259	602
British Mil. Hosp. in Brussels, 1815, Guthrie's Com'taries.	21	4
American War of Secession, Confed. Army, Warren, of N.C.	92	16
New York Hosp., Bost. Med. Jour., May 1, 1872.....	14	0
Pennsylvania Hosp., “ “ “ “.....	58	5
Boston City “ “ “ “ “ “.....	14	4
Mass. Gen. “ “ “ “ “ “.....	36	7
Guy's Hosp. Reports, London.....	15	6
St. Thomas' Hosp., “.....	2	1
St. Bartholomew's Hosp., “ 1853—71.....	45	4
St. George's “ “.....	3	2
Mr. Richardson, at Birmingham, England, 1853—64.....	32	12
Various German Surgeons, Franco-German War.....	22	10
Mr. Nunnely, Leeds Gen. Infirmary, England.....	62	22
Crimean War, Schmidt's Jahrbücher, Bd. 156, S. 249.....	849	489
Dr. Löffler, Danish War with Prussia.....	19	9
Dr. Beck, at Tauberbischofsheim.....	7	2
Siege of Antwerp, Schmidt's Jahrbücher, Bd. 156, S. 249.....	9	1
Franco-German War, “ “ “ “.....	40	19
Schleswig-Holstein War, “ “ “ “.....	19	9
War of 1866, “ “ “ “.....	7	2
Totals.....	4,625	1,226.

Mortality, 27 per cent.

TRAUMATIC SECONDARY.

AUTHORITIES.	CASES.	DEATHS.
Med. Hist. War of Rebellion, Surg. Vol., Part II., p. 697	1,313	416
New York Hospital, Bost. Med. Jour., May, 1872	4	1
Pennsylvania " " " " " "	9	3
Boston City " " " " " "	8	5
Mass. Gen. " " " " " "	8	3
Guy's " London	12	7
St. Thomas' " "	2	0
St. Bartholomew's Hosp., London, 1853-71	29	9
St. George's " "	3	3
Mr. Richardson, Birmingham, 1853-64	15	2
Various German Surgeons, Franco-German War	16	9
British Army in the Crimea	16	6
Schleswig-Holstein War, Dr. Löffler	12	8
Dr. Beck, at Tauberbischofsheim	14	3
Maas and Billroth, each a case	2	2
Siege of Antwerp, Schmidt's Jahrbücher, Bd. 156, S. 249	2	1
Crimean War, " " " "	146	86
Franco-German War, " " " "	31	21
Schleswig-Holstein War " " " "	12	8
War of 1866, " " " "	15	4
American War of Secession, Confed. Army, Warren	100	38
British Mil. Hosp., Brussels, 1815, Guthrie's Commentaries	51	13
Totals	1,820	648

Mortality, 36 per cent.

FOR PATHOLOGICAL CAUSES.

AUTHORITIES.	CASES.	DEATHS.
New York Hospital, Bost. Med. Jour., May 1, 1872	3	0
Pennsylvania " " " " " "	4	1
Boston City " " " " " "	5	1
Mass. Gen. " " " " " "	32	4
Guy's " London, 1861-68	8	2
St. George's " " 1864-68	6	1
St. Thomas' " " " " " "	2	0
St. Bartholmew's " " 1853-71	42	6
London " " 1862-68	5	1
Middlesex " " 1867-68	1	1
Kings College " " 1863-68	4	2
Royal Free " " 1862-68	1	0
Westminster " " 1861-67	3	0
St. Mary's " " 1868	1	0
Edinburg Infirmary, 1859-68	19	7
Glasgow " 1847-68	19	1
Statist. des Hôpitaux de Paris, 1861-63	19	9
Med. Reports, British Army	3	0
Archiv. Klin. Chirurg., Bd. VIII, S. 926, 928, 1088	4	2
Deutsche Zeit. für Chir., Bd. II, S. 380	3	2
Leeds Gen. Infirmary, Mr. Nunnely	20	1
Totals	204	41

Mortality, 20 per cent.

GENERAL SUMMARY OF AMPUTATIONS OF THE ARM.

	LAKE STATES.			ABROAD.		
	CASES.	DEATHS.	PER CENT. MORT.	CASES.	DEATHS.	PER CENT. MORT.
Traumatic primary	15	3	20	4,625	1,226	27
" secondary	8	0	0	1,820	648	36
Pathological	3	0	0	204	41	20
Time and cause not stated	1	0	0	.....	.....	.....
Totals,	27	3	11	6,445	1,874	30

It appears, therefore, that amputations of the arm abroad have a mortality of 30 per cent., which is nearly three times that of the Lake States. Civil cases abroad have also a much greater mortality than military ones, owing to the fact that soldiers are mostly young and vigorous men, and military amputations of the arm are largely done at once on the field of battle, before the patient has been subjected to the deadly miasm of the average military hospital.

OPINIONS OF AUTHORS AND CONCLUSIONS.

The great authorities on surgery, give us almost no advice about the particular indications for amputation of the arm, but fall back on the established general principles, which are these :

1. The superior extremity is of more value than the inferior, and should be sacrificed with more reluctance.

2. Gangrene and diseases of its joints are less dangerous than in the inferior extremity ; hence in certain cases it is less perilous to delay the operation, until its necessity is fully proved.

3. The principal causes requiring amputation of the arm are : first, injuries, where the part of the limb below is pulseless and dead ; secondly, where gangrene from disease has destroyed the limb ; thirdly, where cancer of the member is so situated as to be incapable of full extirpation without amputation.

Severe compound and comminuted fractures of the shaft of the humerus and even of the elbow or the shoulder, do not require amputation, if there is circulation in the part below. Extensive laceration of the soft parts with comminution of the bone makes no difference. Modern surgeons are not appalled by the ghastly looks of the wound. The bone and all the skin and muscles may be severed, but if the artery, and some of the nerves and veins are left, the limb may usually be saved. In like manner, no one now thinks of amputating the arm for caries of the joints, nor for necrosis of the shaft of the humerus, unless some special circumstances render it necessary to disregard the usual principles.

In short, the conservative surgeons have largely won the day, so far as the superior extremity is concerned. At the same time the amputations, if required, are far less dangerous than those of the lower extremity. The primary operations are a little less fatal than the secondary, and the pathological ones (amputations of complaisance excepted) are less than half as dangerous as the traumatic. The mortality of all amputations of the arm in the Lake States is, taking all kinds together, only 11 per cent., which is about one-third the mortality abroad.

Demme, Stromeyer, and Max Schmidt (Schmidt's *Jahrbücher*, 1872,) agree that in gunshot wounds of the elbow joint, conservative treatment is four times more dangerous than resection, while amputation of the arm is intermediate between them. They recommend the conservative treatment, therefore, for mild cases only, and amputation only for cases not admitting of resection. Legouest, (*Traité de Chirurgie d' Armée*, p. 530,) says, speaking of military surgery, "When the elbow has received a comminuted fracture, and the brachial artery is opened, it is necessary to amputate the arm immediately." In my opinion this should depend on whether the collateral circulation keeps up the supply of blood. If it does,

and if some of the large nerves are also intact, resection should be preferred.

AMPUTATIONS AT THE ELBOW JOINT.

Of these I find only two Lake State cases, both of which recovered.

TABLE V.

AMPUTATION AT THE ELBOW JOINT.

OPERATOR.	REASON FOR OPERATION.	Complications	Time.	Result.	Practice.
Dr. E. Andrews Cook Co. Hosp. opr. not stated	Mortification forearm after wound Not stated.....	None ... Not stat.	Second'y Primary	Recover. "	Priv. pr. Hosp...

No conclusions can be drawn from so small a number.

The operation abroad seems equally rare, so that the entire literature of surgery does not furnish us the means of comparing primary, secondary and pathological cases. I find only the following records :

AUTHORITIES.	CASES.	DEATHS.
Pennsylvania Hospital.....	1	0
Dr. Herrgalt, Siege of Strasburg, 1870-71.....	2	2
Other reports in Franco-German War, Deutsch. Zeit. für Chirurgie, B. II, S. 105.....	11	6
Circular No. 6, Surg. Gen. U. S. Army.....	19	0
Statist. des Hôp. de Paris, 1861-2-3.....	4	2
Guy's Hosp. Reports.....	1	0
Leeds' Gen. Infirmary, Mr. Nunneley.....	20	1
Zurich Hosp., 1860-67, Arch. Klin. Chir., Bd. X., S. 891..	2	1
Deutsch. Zeit. für Chir., Bd. II., S. 380.....	1	1
Totals.....	61	13

Mortality, 21 per cent.

This gives fifteen per cent. better results than amputation of the arm, so that it would seem it should be preferred to the latter whenever the choice of location is offered.

OPINIONS OF AUTHORS AND CONCLUSIONS.

Expectant treatment of gunshot wounds of the elbow is to be advised only in the slightest cases. The statistics of the Med. and Surg. History of the War of the Rebellion, p. 829, part II, Surg. Vol., give 938 cases treated conservatively, with only 10 per cent. of deaths; but a great number of these were trivial wounds, and not at all to be classed with those where a bullet had gone through the interior of the joint. I think that in the latter class expectant treatment would be the most dangerous of all procedures.

Amputation at the elbow was first done by Paré, and improved by Brasdor. It gave rise to great differences of opinion among eminent men.

Those opposing or discouraging it are Boyer, Richerand, J. Cloquet, T. J. Roux, (the latter very bitterly,) Chelius (Chelius' Surg., vol. III, p. 718), and Henry H. Smith (Smith's Surg., vol. II, p. 689).

On the other hand, we have in favor of it, Brasdor, Velpeau, Dupuytren, Malgaigne, Legouest, Hamilton, Gross, and Bryant.

Gross speaks of the operation in very high terms, both as to safety and excellence of the stump. (Gross' Syst. of Surg., vol. II, p. 1110.)

Bryant of England, also praises it in the highest terms. (Bryant's Surg., p. 953.)

It is evident that the weight of authority among living surgeons is decidedly in favor of the operation. It should not be substituted for excision, but when an amputation is inevitable, and there is room for a choice of location, the elbow is to be preferred to any point above it.

AMPUTATION OF THE FOREARM.

Owing to the success and safety of conservative treatment of the forearm, amputations of this segment are comparatively rare. I have obtained records of only 20 cases in the Lake States, which are here subjoined :

TABLE VI.
AMPUTATION OF THE FOREARM.

OPERATOR.	Age.	REASON FOR OPERATION.	COMPLICATIONS.	Operati'n.	Con- diti'n.	Time.	Result.	Time to d'h or r'y.	Practice.
Dr. J. H. Hollister	---	Forearm crushed by cars	Intemperate	---	---	Primary	Recovered	---	Hosp. ---
" "	---	" " "	"	---	---	"	"	---	"
" "	---	Gunshot wound of forearm	"	---	---	"	"	---	"
" E. Andrews	---	Injury by R. R.	None	Circular	Good	"	"	2 mos.	Hosp. pra.
" "	---	Gangrene of crushed hand	"	"	---	Secondary	"	6 weeks	Hosp. pra.
" "	---	Injured by cars	"	"	---	Primary	"	32 days	Hosp. pra.
" "	---	Lipus or canceroid of hand and wrist	None	---	Bad	10 years	"	70 "	Hosp. pra.
" J. H. Hollister	---	Wound of forearm by saw	"	---	Good	Primary	"	---	"
" "	---	Wrist severed by sharp instrument	"	---	"	"	"	---	"
Cook Co. Hosp.	---	Discase of parts	---	---	---	---	Died	---	Hosp. pra.
Dr. H. Wardner	---	Hand crushed in foundry	Considerable shock	Low. 3	Med.	Primary	Recovered	3 1/2 wks.	Hosp. pra.
" "	---	" " on boat	"	Mid. 3	---	"	"	3 mos.	"
" E. D. Kittoe	---	Hand and forearm crushed in thresh. mach.	"	Low. 3	Bad	18 hours	"	---	"
" "	---	Scirrhus of hand	" intem.	Low. 3	---	2 years	"	---	"
" E. W. Lee	---	Comp. fract. forearm	Scirrhus of lip removed 3	Flap. 3	Good	Primary	"	3 weeks	"
" "	---	Hand crushed	"	Low. 3	---	"	"	4 "	"
" S. S. Bedal	---	Comp. and com. fract.	None	Cir. low. 3	"	"	"	---	"
" S. Marks	---	Hand crushed	"	Lower 3d	"	Secondary	"	3 weeks	Hosp. pra.
" "	---	Erysipelas and gangrene	"	Upper 3d	Bad	4 weeks	Died	12 days	Hosp. pra.

RECAPITULATION.

	CASES.	DEATHS.	PER CT. MORT.
Total number	20	2	10
Traumatic Primary	14	0	0
" Secondary	2	0	0
Pathological	4	2	50
Hospital Cases	9	1	11
Private Practice	11	1	9

AMPUTATION OF THE FOREARM ABROAD.

The following are the principal published records of this operation :

TRAUMATIC PRIMARY.

AUTHORITIES.	CASES.	DEATHS.
Med. & Surg. Hist. War of Rebel., Surg. Vol., Part II., p. 967	1,007	97
New York Hosp., reported by Sir J. Y. Simpson	10	2
Pennsylvania Hosp., " " " "	83	5
Boston City Hosp., Dr. Cheever	9	0
Mass. Gen. Hosp., reported by Sir J. Y. Simpson	29	7
Guy's Hosp., London	16	1
St. Bartholomew's Hosp., London, 1853 to 1871	48	2
St. George's " "	1	0
U. S. Marine Hosp.	1	0
Dr. Herrgalt, Strasburg, French and German War	4	0
Dr. Beck, Austrian and Prussian War	3	0
Leeds Gen. Infirmary, Mr. Nunneley	60	4
Siege of Antwerp, Schmidt's Jahrbücher, B. 136	6	1
Crimean War, " " " "	175	35
German-French War, " " " "	10	2
Dr. E. Warren's Surg., p. 396, Confederate Army	23	2
British Mil. Hosp. in Brussels, 1815, Guthrie	22	1
Totals,	1,507	159

Mortality, 11 per cent.

TRAUMATIC INTERMEDIARY.

AUTHORITIES.	CASES.	DEATHS.
Med. & Surg. Hist. War of Rebel., Surg. Vol., Part II., p. 967,	450	106
Mortality, 23 per cent.		

INTERMEDIARY AND SECONDARY CASES COMBINED.

AUTHORITIES.	CASES.	DEATHS.
Boston City Hosp., Dr. Cheever.....	2	0
New York " Works of Sir J. Y. Simpson.....	3	1
Pennsylvania " " " " ".....	11	4
Mass. Gen. " " " " ".....	12	2
Guy's " London.....	1	0
St. Thomas' " ".....	1	0
St. Bartholomew's Hosp., London, 1853-71.....	14	2
St. George's " ".....	1	0
Chinese Missionary ".....	1	0
Geissel in French and German War.....	5	0
Beck in Austrian and Prussian War.....	5	1
Crimean War, Schmidt's Jahrbücher, B. 136.....	96	56
German-French War, " " ".....	2	2
Dr. E. Warren's Surgery, p. 396, Confederate Army.....	22	4
British Mil. Hosp. in Brussels, 1815, Guthrie.....	17	5
Totals.....	193	77

Mortality, 40 per cent.

PURELY SECONDARY (AFTER INTERMEDIARY PERIOD).

AUTHORITY.	CASES.	DEATHS.
Med. & Surg. Hist. War of Rebel., Surg. Vol., Part II, p. 967,	184	29

Mortality, 16 per cent.

PATHOLOGICAL CASES.

AUTHORITIES.	CASES.	DEATHS.
Boston City Hospital, Statement of Sir. J. Y. Simpson.....	6	2
New York Hospital, " " ".....	7	2
Pennsylvania " " ".....	6	0
Mass. Gen. " " ".....	27	4
Edinburg Infirmary, 1859-68.....	7	3
Glasgow " 1847-68.....	23	6
St. George's Hospital, London, 1864-68.....	8	4
Guy's " " 1861-68.....	13	5
London " " 1862-68.....	5	0
Middlesex " " 1867-68.....	1	1
King's College " " 1863-68.....	1	1
Royal Free " " 1862-68.....	1	1
Westminster " ".....	4	1
St. Thomas " ".....	2	0
St. Bartholmew's " " 1853-71.....	18	1
Leeds Gen. Infirmary, Statem't of Mr. Nunneley.....	21	3
Billroth's Practice.....	4	2
Other European Cases.....	8	0
Totals.....	162	36

Mortality, 22 per cent.

GENERAL SUMMARY OF AMPUTATION OF THE FOREARM ABROAD.

	CASES.	DEATHS.	PER CENT. MORT.
Traumatic, primary	1,507	159	11
“ intermediary	450	106	23
Intermediary and secondary combined....	193	77	40
Purely secondary	184	29	16
Pathological	163	36	22
Totals	2,496	407	16

Mortality in the Lake States, 10 per cent.

It appears, therefore, that the mortality of this operation among us is less than two-thirds that of the published statistics.

OPINIONS OF AUTHORS AND CONCLUSIONS.

Authors have very little to say on the indications for amputation of the forearm, except to apply the following principles :

1. Conservative treatment is very safe.
2. The arteries and nerves pass down in several trunks, so that they are seldom all destroyed at once.
3. Artificial hands are of very little practical use.

Acting on these truths, surgeons rarely amputate the forearm, except for some injury which has already destroyed the life of the member, or some disease like cancer, which cannot be otherwise gotten rid of. In all severe compound fractures, gunshot wounds, etc., in which there is the least ground of hope that the circulation may recover itself, the effort is made to save the limb. Conservative treatment in the forearm and hand is carried to its fullest extent.

Legouest (*Chirurg. d' Armée*, p 350,) says, that when a bullet traverses the wrist in its greatest diameter, with great shattering, amputation of the forearm will be required.

AMPUTATIONS OF THE WRIST AND HAND IN THE LAKE STATES.

Of these, I find records of only eight cases, all of which recovered.

AMPUTATIONS AT THE WRIST JOINT—ABROAD.

TRAUMATIC PRIMARY.

AUTHORITIES.	CASES.	DEATHS.
Med. & Surg. Hist. War of Rebel., Surg. Vol., Part II, p. 1018	54	5
Pennsylvania Hospital.....	8	0
Dr. Herrgalt, in Strasburg.....	2	0
Leeds General Infirmary, Mr. Nunneley.....	102	8
Siege of Antwerp, Schmidt's Jahrbücher, p. 156.....	1	1
Totals	167	14

Mortality, 8 per cent.

TRAUMATIC INTERMEDIARY.

AUTHORITY.	CASES.	DEATHS.
Med. & Surg. Hist. War of Rebel., Surg. Vol., Part II, p. 1018,	7	1

Mortality, 14 per cent.

PURELY SECONDARY (AFTER INTERMEDIARY PERIOD).

AUTHORITY.	CASES.	DEATHS.
Med. & Surg. Hist. War of Rebel., Surg. Vol., Part II, p. 1018,	5	1

Mortality, 20 per cent.

TRAUMATIC, TIME NOT STATED.

AUTHORITIES.	CASES.	DEATHS.
German Authors	2	1
U. S. Marine Hospital.....	1	0
Crimean War, Schmidt's Jahrbücher, p. 156	67	27
Italian War, " " " "	13	6
German-French War, Schmidt's " " " "	8	0
Totals	91	34

Mortality, 37 per cent.

This increased mortality, as compared with that of the cases known to be primary, may be due to the fact that

the second list is mainly made up of military cases, many of which had other injuries to determine a fatal result, yet it seems impossible to make any satisfactory solution of such palpable discrepancies.

PATHOLOGICAL CASES.

Cases, 14.

Deaths, 1.

Mortality, 7 per cent.

GENERAL SUMMARY OF AMPUTATIONS OF THE WRIST.

LAKE STATES.

Eight cases.

No deaths.

ABROAD.

	CASES.	DEATHS.	PER CENT. MORT.
Primary	167	14	8
Intermediary	7	1	14
Purely secondary	5	1	20
Time not stated	91	34	37
Pathological	14	1	7
Totals,	284	51	18

OPINIONS OF AUTHORS.

Legouest and Albert Malinas, in a work entitled "Conservation," etc., advise conservative treatment in gunshot fractures of the wrist, and, in support of their opinion, give the following facts, on gunshot wounds of this articulation :

	MORTALITY OF CONSERVATIVE TREATMENT.	MORTALITY OF AMPUTATION.
Crimean War	11	28
Italian War	18	25 to 46

Legouest says (*Chirurgie d'Armée*, p. 530) that amputation at the wrist is only required when the injury to the hand is such as to destroy the hope of any future use of it.

Joseph Lister, in Holmes' System of Surgery, vol. V., p. 655, rather discourages the operation, and thinks it no better than amputation of the forearm.

Gross, on the other hand, in his System of Surgery, vol. II., p. 1108, thinks it preferable by far to amputation of the forearm.

Erichsen says it is not often required.

Ashurst's Surgery, p. 115, says if it is done, the disarticulation should be at the radio-carpal junction.

Vidal (*Pathologie Externe*, Tome V., p. 646) approves the operation in suitable cases.

It appears, therefore, that authors conflict somewhat in their opinions of the operation, without any decisive scientific proof on either side. The statistics too are in hopeless contradiction. The Crimean war is said to have given a mortality of 28 per cent.; the Italian war is stated variously from 13 to 46 per cent., and the late American war at only 5 per cent. No results can be deduced from such utterly irreconcilable statements. Science must wait for a better collection of facts.'

AMPUTATIONS THROUGH THE METACARPUS.

No records for the Lake States. Abroad, seventy-six cases are recorded without a death.

AMPUTATION AT THE HIP JOINT.

Of this important operation I obtain records of the following seven cases in the Lake States:

RECAPITULATION.

Total number of cases	7	Died.....	3
Traumatic	2	"	1
Pathological	5	"	2

AMPUTATION OF THE HIP JOINT ABROAD.

The Surgeon-General of the U. S. Army, in Circular No. 2, publishes a report of Asst. Surg. Geo. A. Otis, M. D., which carefully collects the published cases of the world up to 1869 (Cir. No. 2, S. G. O.), so far as performed for gunshot wounds. Of these, 115 were in the Crimean and other foreign wars; 62 were in the American war, and 6 were later cases. Asst. Surg. Otis gives in Circular No. 2, p. 112, the following condensation of the whole:

AMPUTATIONS AT THE HIP JOINT FOR GUNSHOT WOUNDS ABROAD.

	CASES.	DIED.	PER CENT. MORTALITY.
Primary (finished cases)	76	75	99
Intermediary	76	70	92
Secondary (after intermediary)	20	13	65
Re-amputations	8	4	50
Totals	180	162	90

The New York, Boston and Mass. general hospitals give five traumatic primary cases, all fatal.

AMPUTATION AT THE HIP JOINT FOR PATHOLOGICAL CAUSES.

AUTHORITIES.	CASES.	DIED.
Lake State Surgeons (see table No. VII. above)	5	2
Guy's Hosp. Reports	1	1
St. Thomas' Hosp. Reports	2	0
St. Bartholomew's Hosp., 1853 to 1863, Mr. Callender.....	1	0
Statist des Hôpit. de Paris, 1861-2-3.....	3	3
Mass. Gen. Hosp.	2	2
Leed's Gen. Infirmary, Mr. Nunneley.....	2	1
Ashurst's Surgery, p. 131	42	18
Totals	58	27

Mortality in pathological cases, 47 per cent.

OPINIONS OF AUTHORS AND CONCLUSIONS.

Opinions on this amputation have formerly been widely conflicting, but as statistics have accumulated and thrown light on its results, a greater degree of unanimity has been attained.

In 1740, the Academy of Surgery in Paris opposed the operation, when one of its members wished to perform it. In 1848 they approved it. In 1859 they again discussed it, and of forty-four opinions, thirty-four justified it. (*Pathologie Externe par Vidal, Tome V., p. 703.*)

Chelius, vol. III., p. 689, justifies it when a crushing or mortification extends so high as to prohibit amputation below the trochanter.

Stromeyer (*Maximen der Kriegsheilkunst*) declared in 1861 that it was not yet proved justifiable in military surgery.

Loeffler (*Grundsätze und Regeln für die Behandlung der Schusswunden im Kriege*) took similar ground. Rochard, in Saurel's *Traité de Chirurgie Navale*, pronounced it improper in the primary stage, and Sedillot maintained for years that the primary amputation was never successful.

Baron H. Larrey and M. Legouest (*Memoires de la Societé de Chirurgie, Tome V.*) obtained a definite opinion from the Society of Surgery, that the operation was unjustifiable unless the thigh was almost torn away from the trunk.

Erichsen's Surgery, vol. II., p. 301, seems to speak rather flippantly and without consideration of the terrible danger of the operation. It advocates it, not only where the disease of the femur is too extensive for excision, but even for limbs rendered simply useless by atrophy, deformity, etc. Curiously enough, in disregard of the fact that amputation is more dangerous than excision, the author recommends it as a choice, where the health is supposed to be too low to bear the excision.

Joseph Lister, in Holmes' System of Surgery, vol. V., p. 651, says it is justifiable in some desperate circumstances.

Henry H. Smith (Prin. and Pract. of Surg., vol. II., p. 694,) assumes that it may be required, and forbids the circular operation as specially objectionable.

Gross (System of Surgery, vol. II., p. 1127,) says, amputa-

tion at the hip is never to be undertaken except where there is no other chance of life.

Asst. Surg. Geo. A. Otis, M. D., the author of Circular No. 2, S. G. O., after a careful survey of the war records, and of European opinions and military experience, arrives for gunshot cases at the following conclusions (Cir. No. 2, pp. 122, 123):

“Amputation at the hip joint, for gunshot injury, notwithstanding its great fatality, cannot be altogether discarded, and should be performed under the following circumstances: 1. When the thigh is torn off, or the upper extremity of the femur comminuted with great laceration of the soft parts, in such proximity to the trunk that amputation in the continuity is impracticable. 2. When a fracture of the head, neck or trochanter of the femur is complicated with wound of the femoral vessels. 3. When a gunshot fracture, involving the hip joint, is complicated by a severe compound fracture of the limb lower down, or by a wound of the knee joint.

“There are two other possible contingencies under which primary or early intermediate coxofemoral amputations for injury may be admissible: 1. When, without fracture, a ball divides the femoral artery and vein near the crural arch. 2. When a gunshot fracture in the trochanteric region is complicated by such extensive longitudinal fissuring as to preclude excision. Experience has yet determined nothing on these points. Secondary amputations and re-amputations at the hip, in military surgery, should be performed when, from caries, or necrosis, or chronic osteomyelitis following gunshot wounds, or amputations in the continuity, the patient's life is in jeopardy.

“Restricted to the classes of cases above enumerated, coxofemoral amputation will occasionally save lives that would otherwise be inevitably lost.

“Primary excisions of the head or upper extremity of the femur, should be performed in all uncomplicated cases of gunshot fracture of the head or neck. Intermediate excisions are indicated in similar cases where the diagnosis is not made out till late, and also in cases of gunshot fracture of the trochanters with consecutive arthritis. Secondary excisions are

demanded by caries of the head of the femur, or secondary involvement of the joints, resulting from fractures in the trochanteric region or wounds of the soft parts in the immediate vicinity of the joint.

“Expectant treatment is to be condemned in all cases in which the diagnosis of direct injury to the articulation can be clearly established.

“Although the great majority of cases complicated by lesions of the pelvis terminate fatally, the successful operation of Dr. Schönborn proves that a slight injury of the margin of the acetabulum does not contra-indicate the operation of excision.

“Experience teaches that considerable portions of the shaft may be with propriety removed with the head, neck and trochanters, in cases in which splintering extends below the trochanter minor.”

In the light of all the known facts, I think that these remarks of Dr. Otis are the best considered, and most carefully stated conclusions ever made, up to the time they were penned, and that to a certain extent they are applicable to other traumatic cases.

Since they were written, however, the whole system of treating wounded joints by antiseptic methods has been developed, and the question has arisen whether a certain number of shattered hips heretofore deemed to require amputation or excision would be better treated by laying open the joint freely, removing dead fragments, and treating by Lister's antiseptic methods. Probably they would, but science has not yet given the means of a positive answer, so that a painful darkness still hangs over some portions of the subject of hip joint injuries. The antiseptic consideration, however, would affect the question of excision more than that of amputation, as at the present time few would think of amputating at the hip for recent injuries, unless the limb were destroyed, or gangrene inevitable, and therefor antiseptic treatment out of the question.

There is yet one other condition in which antiseptic method might possibly come in to postpone or supersede amputation in a few rare cases. If the limb is carried away by a shot, too high for amputation below the trochanter, it has been deemed

unavoidable that the patient must take the added terrible shock of a primary amputation at the hip, though his chance of surviving it is not over one in a hundred. The antiseptic method enables us in most cases to promptly subdue the local inflammation, and to completely suppress the exhausting drainage of suppuration, so that some of these cases might probably be better treated by this plan, and thus either healing the parts by granulation without operation, or else postponing the amputation to a late secondary period, when it is much safer. This principle has proved abundantly successful in some parts of the body, but there is no recorded experience of its application to hip joint wounds.

The principal pathological indication for this amputation has hitherto been cancer of the thigh, so situated as to admit of complete removal in no other way. Some instances are on record where it has been successfully done and the patient lived in comfort for years, though perhaps there may be doubt about the correctness of the diagnosis in a part of them. The whole thing lies in a nutshell. If the tumor is really malignant, there is no reasonable expectation of a permanent cure, and as pathological amputations have a mortality of 47 per cent., they have about one chance in two of killing the patient at once. The question therefore is this: Granted that there is no rational expectation of a permanent cure, and only a moderate hope of prolonging the life, is an operation, which kills immediately one-half the patients, desirable? It is evident that the prospect is greater for shortening than for lengthening the life by the operation, in such circumstances. It would seem to be justified, therefore, only in those cases where the terrible pains of the disease call for operative relief, at almost any risk.

Caries extending far down the femur, can hardly be called an indication for amputation at the hip, now that we understand the value of subperiosteal excision of bony shafts.

AMPUTATION OF THE THIGH.

This important operation furnishes us the following list of cases in the Lake States: •

TABLE VIII.

AMPUTATION OF THE THIGH.

No. Am- drew's Sur. Rec	OPERATOR.	Age.	REASON FOR OPERATION.	COMPLICATIONS.	Operat'n at opt	Cond. at opt	Time to operation.	Result.	Time to death or recovery	Practice.
5471	Dr. E. Andrews	16	Protrusion of bone after prev. amput.		Re-a. m. 3	Good	Secondary	Recover'd	9 days	Hospital.
---	" E. W. Lee	22	Comp. fract. of leg.		Flap low 3	Med.	"	Died	3 weeks	Private
---	" "	10	"		Lower 3d	Good	Primary	Recover'd	---	---
8880	" E. Andrews	9	Leg crushed by cars	Great shock	Flap. m. 3	Bad.	"	Died	6 days	Hospital.
7726	" "	30	Carious knee.	Much exhausted.	"	"	2½ years	"	---	Private
7727	" "	20	"	None	"	Good	6	Recover'd	---	---
7752	" Not stated	30	"	Suspected phthisis.	Lower 3d	Med.	8	"	---	---
---	" S. S. Badal	64	Comp. fract. thigh.	Gangrene.	Mid. 3 cr.	Good	10 days	"	---	---
---	" Thos. Lacy	---	Disease of knee.	None	Flap. low 3	Good	13 years	"	---	Private
775	" E. Andrews.	17	Gangrene from injury.	Intemperate.	"	"	6 days	"	---	---
1612	" "	40	Comp. fract. of knee.	None	"	"	Primary	"	---	---
1653	" "	---	Knee crushed by timber.	Had been previous exsec.	"	"	"	"	---	---
5488	" Caries of knee.	---	"	"	"	"	"	"	---	---
---	" J. S. Sherman	36	R. R. accident, drunk	Crushed thigh and op leg	Am.	Bad.	Primary	Died	6 mos.	Hospital.
1359	" E. Andrews.	5	Comp. fract. leg	Opposite knee bruised	Flap. low 3	Med.	Secondary	Recover'd	1 hour	Private
6397	" "	50	Senile gangrene	Intemperate.	"	"	6 days	"	10 weeks	Hospital.
---	" R. Gunn	50	Comp. fract. of femur.	None	"	"	Primary	"	7 weeks	Private
---	" R. Isham	50	Comp. fract. of knee.	None	"	Bad.	36 hours	Died	48 hours	Private
---	" La Count	50	Chronic inflam. of knee	None	"	"	Some mos.	Recover'd	---	---
---	" H. A. Johnson	33	Crushed knee and hemorrhage.	Great shock	"	Good	Primary	Died	1 hour	Hospital.
---	" E. Andrews	32	Cancer of knee.	"	"	Bad.	"	Recover'd	---	---
---	" J. W. Freer	25	Comp. and commin. fract. of leg.	"	Lower 3d	"	Primary	"	10 weeks	"
---	" G. Ammerman	7	"	Wounds op. limb, g. shock	"	Bad.	"	Died	---	---
---	" A. F. Her-	10	Cancer of tibia.	"	"	"	1 year	Recover'd	---	Private
---	" "	19	Caries of knee and mort. of leg	"	"	"	9 months	"	7 weeks	"
---	" "	35	"	"	"	"	2 years	"	6	"
---	" "	8	Freezing of leg	"	"	Med.	6 months	"	5	"
---	" "	39	Chronic inflam. of knee with caries	"	"	"	2½ years	"	7	"
---	" "	30	"	"	"	Bad.	3	"	10	"
---	" "	20	Knee joint nearly severed with ax.	Inflamed-suppurating.	"	"	6 hours	"	6	"
---	" "	40	Gunshot wound of knee joint.	None	"	"	3 weeks	"	8	"
---	" Hyde	41	Comp. and commin. fract. leg.	"	"	Good	Primary	"	2 mos.	"
---	" J. H. Hollister	7	Knee crushed by car wheel.	"	"	"	"	"	---	Hospital.
---	" E. Owens	---	"	"	"	"	"	"	---	---

RECAPITULATION.

	CASES.	DIED.	PER CENT. MORTALITY.
Total of all kinds	76	18	24
Traumatic, primary, upper 3d.....	5	2	40
" intermediary or secondary upper 3d	1	1	
Pathological, upper 3d.....	2	0	
Traumatic, primary, middle 3d	4	3	
" intermediary and secondary combined, middle 3d	5	1	
Pathological, middle 3d	7	2	
Traumatic, primary, lower 3d.....	18	5	28
" intermediary and secondary combined, lower 3d.....	9	3	33
Pathological, lower 3d.....	22	0	0
Hospital cases	20	6	30
Private practice.....	54	11	20

There is on record in the literature of surgery a prodigious mass of cases of amputation of the thigh, but, unfortunately, most of them are so destitute of details that they cannot be properly classified. Generally there is no statement in what portion of the thigh the operation took place, and often the essential distinction into primary, secondary and pathological cases is ignored. The statistics of the upper two-thirds are especially meagre.

AMPUTATION UPPER 3D OF THIGH ABROAD, TRAUMATIC PRIMARY.

AUTHORITIES.	CASES.	DIED.
Rept. Boston City Hosp., Dr. Cheever.....	11	11
Mass. Gen. Hosp. Rept., 1871.....	13	7
Dr. Herrgolt, Siege of Strassburg, 1870-71	2	1
Dr. Nunneley, Leeds Gen. Infirmary	9	2
Dr. E. Warren's Surg., p. 395, Confed. Army	5	3
Totals.....	40	24

Mortality abroad, 60 per cent.

AMPUTATION UPPER 3D OF THIGH ABROAD, INTERMEDIARY AND
SECONDARY COMBINED.

AUTHORITIES.	CASES.	DIED.
Circular No. 3, Surg. Gen. U. S. A.-----	7	2
Dr. Herrgolt, Siege of Strassburg, 1870-71-----	6	5
Dr. E. Warren's Surg., p. 395, Confederate Army-----	5	1
Totals-----	18	8

Mortality abroad, 44 per cent.

AMPUTATION UPPER 3D OF THIGH ABROAD, PATHOLOGICAL.

AUTHORITIES.	CASES.	DIED.
Circular No. 3, Surg. Gen. U. S. A.-----	3	1
Rept. Bost. City Hosp., Dr. Cheever-----	2	1
“ Mass. Gen. Hosp., 1871-----	15	4
“ U. S. Marine Hosps., Dr. Woodworth-----	1	0
Leeds Gen. Infirmary, Mr. Nunneley-----	9	2
Totals-----	30	8

Mortality abroad, 27 per cent.

AMPUTATION MIDDLE 3D OF THIGH ABROAD, TRAUMATIC PRIMARY.

AUTHORITIES.	CASES.	DIED.
Circular No. 3, Surg. Gen. U. S. A.-----	2	1
Rept. Boston City Hosp., Dr. Cheever-----	4	4
“ Mass. Gen. Hosp., 1871-----	13	6
Dr. Herrgolt, Siege of Strassburg, 1870-71-----	1	1
Dr. E. Warren's Surg., p. 395, Confederate Army U. S.-----	13	4
Totals-----	33	16

Mortality abroad, 48 per cent.

AMPUTATION MIDDLE 3D OF THIGH ABROAD, TRAUMATIC, INTERME-
DIARY AND SECONDARY COMBINED.

AUTHORITIES.	CASES.	DIED.
Circular No. 3, Surg. Gen. U. S. A.-----	4	1
Rept. Boston City Hosp., Dr. Cheever-----	4	1
“ Mass. Gen. Hosp., 1871-----	7	3
Dr. Herrgolt, Siege of Strassburg, 1870-71-----	9	8
Dr. E. Warren's Surg., p. 395, Confederate Army U. S.-----	15	10
Totals-----	39	23

Mortality abroad, 59 per cent.

AMPUTATION MIDDLE 3D OF THIGH ABROAD, PATHOLOGICAL.

AUTHORITIES.	CASES.	DIED.
Circular No. 3, Surg. Gen. U. S. A.	4	1
Rept. Boston City Hosp., Dr. Cheever	4	1
“ Mass. Gen. “ 1871	47	10
“ Rostoch “	1	0
Totals	56	12

Mortality abroad, 22 per cent.

AMPUTATION LOWER 3D OF THIGH ABROAD, TRAUMATIC, PRIMARY.

AUTHORITIES.	CASES.	DIED.
Circular No. 3, Surg. Gen. U. S. A.	6	3
Rept. Boston City Hosp., Dr. Cheever	13	10
“ Mass. Gen. Hosp., 1871	35	12
Dr. Herrgolt, Siege of Strassburg, 1870-71	2	2
Dr. E. Warren's Surg. Confederate Army	27	10
Totals	83	37

Mortality abroad, 45 per cent.

AMPUTATION LOWER 3D OF THIGH ABROAD, INTERMEDIARY AND SECONDARY COMBINED.

AUTHORITIES.	CASES.	DIED.
Circular No. 3, Surg. Gen. U. S. A.	3	0
Rept. Boston City Hosp., Dr. Cheever	4	1
“ Mass. Gen. Hosp., 1871	8	6
“ U. S. Marine Hosp.	1	0
Dr. Herrgolt, Siege of Strassburgh, 1870-71	1	1
	43	28
Totals	60	36

Mortality abroad, 60 per cent.

AMPUTATION LOWER 3D OF THIGH ABROAD, PATHOLOGICAL.

AUTHORITIES.	CASES.	DIED.
Circular No. 3, Surg. Gen. U. S. A.	2	0
Rept. Boston City Hosp., Dr. Cheever.....	7	2
“ Mass. Gen. “ 1871	101	19
“ Rostoch “	3	0
“ British Army	2	1
* Glasgow Infirmary	92	19
* St. Thomas Hosp., 1835-40.....	13	4
* Univ. College Hosp., 1843.....	54	10
* Hussey	55	10
* James at Exeter.....	119	10
* Cases in Med. Times and Gazette, 1851-57.....	54	9
* Addenbrooke's Hosp., Cambridge.....	92	17
* St. George's Hosp., 1866.....	12	6
* London Hosp., 1854-57	169	38
* Provincial Hosps.	134	33
Totals.....	909	178

Mortality Abroad, 20 per cent.

AMPUTATION THIGH ABROAD, TRAUMATIC, PRIMARY, PLACE NOT STATED.

AUTHORITIES.	CASES.	DIED.
Dr. E. Warren's surg., p. 395, Confederate Army	25	9
Guy's Hosp. Repts.	12	5
St. Thomas' Hosp.	5	2
St. Bartholomew's Hosp., 1853-71.....	26	9
Penn. Hosp.	24	10
Mass. Gen. Hosp.	60	25
Malgaigne, quoted in Gant's Surg., p. 689.....	46	34
Other cases “ “ “	24	24
Birmingham Gen. Hosp., 1853-64.....	19	13
Deutsches Zeitschrift f. Chir. B. 1, S. 187, }	23	15
German-French War, }		
Same work, B. V., S. 26	5	4
Bech's Kriegschir	10	4
Circular No. 6, Surg. Gen. U. S. A.	423	229
New York Hosp.	16	12
Boston City Hosp.	21	15
Siege of Antwerp, Schmidt's Jahrbücher, B. 156.....	12	2
“ “ Paris, 1830-32 “ “	3	0
German-French War “ “ “	27	17
Crimean War “ “ “	1589	1424
Italian “ “ “	109	85
German “ 1866 “ “ “	11	5
Totals.....	2490	1943

Mortality, 78 per cent.

* Archiv. Klin. Chir. B. VIII. S. 910. These are all amputations for disease of the knee; they must therefore have been, with few exceptions, in the lower 3d, and are consequently classed as such.

AMPUTATION OF THIGH ABROAD, INTERMEDIARY AND SECONDARY
COMBINED, TIME NOT STATED.

AUTHORITIES.	CASES.	DIED.
Guy's Hosp. Repts.	11	9
St. Thomas' Hosp. Repts.	2	1
St. Bartholomew's Hosp., 1853-71.	53	29
Birmingham Gen. Hosp., 1853-64.	67	15
Gant's Surg., p. 689, Military cases.	300	270
Billroth and others, in German-French War.	34	22
Beech's Kriegschirurgie.	41	22
Circular No. 6, Surg. Gen. U. S. A.	638	477
Mass. Gen. Hosp.	15	9
New York "	14	6
Boston City "	4	3
Pennsylvania "	15	6
Siege of Antwerp, Schmidt's Jahrbücher, B. 156.	3	1
Paris, 1830-32 " " " "	6	4
German-French War " " " "	52	39
Crimean " " " "	221	197
Italian " " " "	128	107
German War, 1866 " " " "	47	28
Dr. E. Warren's Surg., Confederate Army.	39	34
Totals.	1690	1279

Mortality abroad, 76 per cent.

AMPUTATION OF THIGH ABROAD, PATHOLOGICAL, PLACE NOT STATED.

AUTHORITIES.	CASES.	DIED.
Guy's Hosp. Repts., 1861-68.	83	27
St. Thomas Hosp. Repts.	9	1
St. Bartholomew's Hosp. Repts., 1853-71.	278	89
St. George Hosp., 1864-68.	54	25
London Hosp., 1862-68.	68	23
King's College Hosp., 1863-68.	14	5
Royal Free " 1862-68.	6	1
Westminster " 1861-67.	5	4
St. Mary's "	6	1
Brit. Army Med. Rep.	3	0
Mr. H. D. Cardin, of Worcester.	6	0
New York Hosp.	21	6
Pennsylv. "	37	9
Boston City "	16	4
Mass. Gen. "	162	34
Totals.	768	229

Mortality abroad, 30 per cent.

The following are figures from various authorities, in which the particulars of time, place, etc., are more imperfectly given than the above:

AMPUTATION OF THIGH, DETAILS, TIME, PLACE AND CAUSE IMPERFECTLY STATED.

AUTHORITIES.	CASES.	DIED.	PER CENT. MORTALITY.
Military cases from American and various European Wars, after deducting figures previously quoted.....	2156	1441	67
Civil Cases from various Sources.....	1243	713	57
Totals.....	3399	2157	63

GENERAL SUMMARY OF AMPUTATIONS OF THE THIGH.

TOTALS.	LAKE STATES.			ABROAD.		
	CASE	DIED	PER CT. MORT	CASE	DIED	PER CT. MORT
Upper 3d, primary.....	5	2		40	24	60
“ intermediary and secondary.....	1	1		18	8	44
“ pathological.....	2	0		30	8	27
Middle 3d, primary.....	4	3		33	16	50
“ intermediary and secondary.....	5	1		39	23	59
“ pathological.....	7	2		56	12	22
Lower 3d, primary.....	18	5	28	83	37	45
“ intermediary and secondary.....	9	3	33	60	36	60
“ pathological.....	22	0	00	909	178	20
Place not stated, primary.....				2490	1943	78
“ “ “ intermediary and secondary.....				1690	1279	76
“ “ “ pathological.....				768	229	30
Conditions not stated at all.....	3	1		3399	2157	63
Totals.....	76	18	24	9615	5950	62

It appears, therefore, that the average mortality of amputation of the thigh, in the Lake States, is considerably less than half that given in the published statistics elsewhere.

OPINIONS OF AUTHORS.

Authors contradict each other somewhat as to the conditions requiring amputation of the thigh.

Erichsen, vol. II., pp. 200 and 237, advises immediate

amputation of all compound gun shot fractures of the femur, except in the upper third.

On the other hand the *Archives Générales de Médecine* (tome xiii., serie 5e) says that in the Crimean War conservative treatment of gun shot fractures of the femur, or of any other part of the inferior member, was five times more successful than amputation. Yet Macleod, discussing the same war, says, we ought to use conservative treatment in the upper third, and amputation in the middle and lower thirds.

Hamilton says, in gun shot fractures of the middle third conservative treatment and amputation have equal success, while conservative treatment is the most fatal in the lower third. This is doubtless because gun shot fractures in the lower third are apt to split into the knee joint, thus opposing a very dangerous complication to conservative success.

In contradiction to this difference of the upper and lower thirds, Max Schmidt (*Schmidt's Jahrbücher*, 1872) says all the war statistics of 1830 show that conservative treatment of gun shot fractures of the thigh is more successful than amputation, *in every portion* of the member.

Denme and Legouest give statistics to the same end (see same article), showing that in all parts of the thigh, treated for gun shot fractures, the mortality of amputation exceeded that of conservative treatment by the following amounts:

					DEMME.	LEGOUEST.
Mort. of amp. in upper 3d	exceeds	conser. treat. by			29 pr. ct.	27 pr. ct.
" " middle 3d	"	"			11 "	26 "
" " lower 3d	"	"			18 "	32 "

Legouest elsewhere states (*Chirurgie d'Armée*, p. 537), that in the battle of Langensalza, 1866, and in the French army in the Crimea, and in Italy, conservative treatment of the thigh was most successful by about nineteen per cent.; while in the English army in the Crimea, in the American war of secession, in the Schleswig-Holstein war and in Stromeyer's figures from the battle of Langensalza, amputations of the thigh were more successful than conservative treatment by about fourteen per cent.

Dr. Albert Malinas (Conservation, Paris, 1872, p. 51) gives

a table showing that gun shot fractures in the thigh, in the Crimea and in the Italian war, according to the experience of the French army, were better treated conservatively than by amputation. He says the results were these:

	MORTALITY OF CONSERVATIVE TREATMENT OF THIGH.	MORTALITY OF AMPUTATION OF THIGH.
Crimean War.....	35 per cent.	{ Upper 3d, 94 per cent. Middle 3d, 94 per cent. Lower 3d, 90 per cent.
Italian War	58 per cent.	64 per cent.

Dr. S. W. Gross, in the October number of the *Am. Jour. Med. Sci.*, 1867, carefully collated the statistics on this subject, from which essay I condense the following points respecting gun shot fractures of the thigh, treated some by amputation and some by conservative treatment:

TREATMENT OF GUN SHOT FRACTURES OF THE THIGH.

AMPUTATIONS.

	CASES.	DIED.	PER CENT. MORTALITY.
All kinds Combined.....	4123	3146	76
Primary.....	695	381	55
Secondary (and Intermediary).....	753	572	76
Franco-Sardinian Army in Italy, and { Upper 3d..	225	177	79
British Army in Crimea. { Middle 3d..	268	175	65
{ Lower 3d..	236	130	55

CONSERVATIVE TREATMENT.

	CASES.	DIED.	PER CENT. MORTALITY.
Franco-Sardinian Army in { All kinds combined	1450	923	64
Italy, in 1859, French { Upper 3d.....	445	306	69
Army in Crimea and Am. { Middle 3d.....	327	181	55
War of Secession. { Lower 3d.....	295	150	51

He concludes that in gun shot fractures of the thigh, conservative treatment is better than amputation by twelve per cent., the lower third being no exception, and better than exsection of the femur by twenty-four per cent.

Billroth, of Vienna, in his letters from the late German-French war, collates figures from various wars, which foot up as follows:

CONSERVATIVE TREATMENT OF GUN SHOT FRACTURE OF THIGH.	MILITARY AMPUTATION OF THIGH.
Cases.....1339	Cases.....3721
Died.....949	Died.....2826
71 per cent. mortality.	76 per cent. mortality.

As already stated, the *Archives G n rales de M d.*, 1859, has an article claiming that, in the Crimean war, conservative treatment for gun shot fracture of the leg and thigh was five times more successful than amputation. It is evident that the opinions of the most eminent men are in utter contradiction on this subject; and by some inexcusable blundering the figures are in the same situation. The truth is that military statistics are often extremely delusive, in consequence of the improper manner in which they are collected. We will discuss this matter further under the head of "Conclusions."

Formerly all gun shot fractures of the femur were supposed to demand amputation, but Malgaigne defended, before the French Academy, the opinion that conservative treatment should be tried wherever the circumstances did not compel amputation. Velpeau and Jobert (de Lamballe) sustained him.

Hamilton (*Military Surgery*, p. 399) advises to amputate the thigh for gun shot fracture: 1. When the patient must be carried far, over rough roads without adequate support to limb. 2. When the bones are greatly comminuted. 3. When there are uncontrollable pains and spasms. 4. When there is great contusion or laceration of soft parts. 5. When the principal arteries or nerves are destroyed. 6. When the fracture is at or near the knee.

He advises not to amputate: 1. When the bullet fractures the head, neck—trochanter—or shaft just below the trochanter. 2. When the wound is from a pistol, a spent ball, or any projectile which makes but little comminution.

Longmore, in his article in *Holmes' System of Surgery*, vol. ii, p. 227, quotes the statistics of the American war as showing that conservative treatment of gun shot fractures of the upper third of the thigh was three per cent. more successful than amputation, and hence recommends conservatism in uncomplicated cases. In the middle and lower thirds he recommends amputation, as shown by statistics to be slightly safer in the middle, and decidedly safer in the lower third than conservative treatment. His figures from Circular No. 6, S. G. O., are so erroneously quoted that I am obliged to correct them from the original document:

	CONSERV. TREAT.			AMPUTATIONS.		
	CASE	DIED	PER CT. MORT	CASE	DIED	PER CT. MORT
Upper third.....	330	237	72	32	24	75
Middle third.....	238	132	55	93	51	55
Lower third.....	173	101	58	243	112	46

Circular No. 6, of the U. S. Surg. Gen., compares conservative treatment of gun shot fractures of the knee, with treatment by amputation just above, with the following results:

	CASES.	DIED.	PER CENT. MORTALITY.
Gun Shot Fracture of Knee, treated by Amp.			
Lower Third of Thigh.....	452	331	73
Same Injury Conservatively Treated.....	308	258	84

Dr. E. Warren, of the Confederate army, and Surg. Gen. of North Carolina, gives, in his "Surgery of the Field and Hospital," two hundred and one cases of fractured knee joint from the Richmond hospitals, with one hundred and twenty-one deaths, a mortality of sixty per cent. He remarks judiciously that these figures do not represent the whole truth, as many bad cases died before reaching the hospitals. Were these added the mortality would doubtless be greater.

The *Deutsch Zeitschrift für Chir.*, Bd. 2, S. 106, gives,

from the German-French war, thirty-four cases of penetrating gunshot wounds of the knee joint, with twenty-four deaths; a mortality of seventy per cent.

Max Schmidt (*Jahrbücher*, 1872) advocates conservative treatment—not only in wounds about the knee, not penetrating the capsule, but also in the simpler intracapsular wounds.

Surgeon J. M. Woodworth, formerly Med. Director of the Army of the Tennessee, and now Supervising Surgeon of Marine Hosps., claims, on the contrary, that almost all gun shot openings of the knee joint, even if the bones are not fractured, should, in military practice, be amputated.

Guthrie (*Commentaries on the Crim. War*) says gun shot fractures of the knee joint imperatively require primary amputation; but that if the patella alone be broken, and that only moderately, delay may be allowed. At page 151 he maintains that when gun shot fractures of the lower half of the femur do not communicate with the knee joint, conservative treatment should always be preferred.

CONCLUSIONS.

From this somewhat contradictory mass of opinions on one of the plainest operations in surgery we see how far from being settled many precepts of our art still are. We will try to evolve partial order out of the chaos, and where this is impossible we will at least ascertain what points are still unknown, and must wait the further growth of science for light upon them.

1. It is settled forever, as every one knows, that the nearer the operation comes to the body the greater the risk, other things being equal. There is an apparent exception in the traumatic secondary cases, for in these the mortality of secondary cases increases as we approach the knee. This is probably due to the inclusion of many cases in which compound fractures opened that joint, producing suppuration, etc., in which accident the earlier secondary amputations are excessively fatal. Amputations in the height of an active suppurating inflammation of the knee are considered almost necessarily fatal. Did the published records admit of our sifting out

these knee cases, we should probably find that the remaining secondary cases followed the usual rule of increasing danger as we approach the body.

Our average Lake State mortality for all amputations of the thigh is only 24 per cent. against 62 per cent. elsewhere. Our number in the upper two-thirds are too small to establish reliable averages, but if we distribute the 24 per cent. risk according to the experiences elsewhere, we shall have the following as our probable rates:

PROBABLE RISK OF AMPUTATIONS OF THIGH IN THE LAKE STATES.

Upper 3d	Primary	.....	about 30 per cent.
"	3d Intermediary	.....	" 45 " "
"	3d Purely secondary	.....	" 20 " "
"	3d Pathological	.....	" 18 " "
Middle 3d	Primary	.....	" 24 " "
"	3d Intermediary	.....	" 36 " "
"	3d Purely secondary	.....	" 25 " "
"	3d Pathological	.....	" 15 " "
Lower 3d	Primary	.....	" 22 " "
"	3d Intermediary	.....	" 45 " "
"	3d Purely secondary	.....	" 25 " "
"	3d Pathological	.....	" 10 " "

These figures can only be approximate, of course. Massive as are the published statistics of amputations of the thigh abroad, most of them are in such a wretchedly crude and even contradictory condition, that their usefulness is in a great measure lost, and proportions taken from them and applied to our cases must be received with many allowances.

I ought to say here that in the division into traumatic and pathological, experience shows that amputations of "expediency," or "complaisance," that is, amputations performed to remove deformities, on limbs otherwise healthy, have a mortality much greater than other pathological cases, and rank nearly the same as traumatic primary operations.

The above averages will do as a starting point, but in each case we must consider the individual modifying circumstan-

ces. If the patient's condition and surroundings are better than usual, his risk will be much less; and if the reverse, it will, of course, be greater than the above average.

Injuries which, like bullet wounds, comminute the bones in the interior of the knee, require primary amputation, but if the period for this has already passed, the patient is in a very dangerous situation, as amputations of these cases are desperately perilous during the acute portion of the suppurative stage, and excisions are the same, while delay is not much better. Perhaps the best way would be to open the joint, pick out the fragments, apply Lister's carbolic acid treatment thoroughly every day, and keep up extension of the leg by adhesive plasters, weight and pulley, and thus carry the case over the period of acute activity, when the risk of an amputation will be greatly diminished.

This is only a suggestion, for which there is no accumulation of experimental proof as yet adduced.

Ordinary compound fractures, not comminuted, but yet extending into the knee joint, were often best treated in former times by a primary amputation; but at present, he that is master of the antiseptic methods, and bold enough to apply them thoroughly, will find them more useful than amputation for such cases, if seen immediately.

Military fractures of the thigh, not implicating the knee joint, and not accompanied with such injuries to vessels or other parts as will produce mortification of the member, are best treated conservatively, and especially so in the upper half of the thigh.

AMPUTATION AT THE KNEE JOINT.

This operation has evidently not been a favorite in the Lake States, as I have no cases of it reported to me. Abroad the following statistics are found:

PRIMARY.

AUTHORITIES.	CASES.	DIED.
Boston City Hosp. Rep. Dr. Cheever	1	0
St. Bartholomew's Hosp., 1863-71	2	0
Mass. Gen. Hosp.	5	3
Circular No. 6, Surg. Gen. U. S. A.	49	16
Crimean War, Schmidt's Jahrbücher, Vol. 156, p. 250	39	31
German-French War, " " " " " "	1	1
American Jour. Med. Sci., 1868, pp. 333, 555. Dr. Brinton	109	47
Totals	206	98

Mortality, 48 per cent.

INTERMEDIARY AND SECONDARY COMBINED.

AUTHORITIES.	CASES.	DIED.
Dr. D. Cheever, Boston	1	1
St. Bartholomew's Hosp., 1863-71	1	0
Seige of Strassburg, 1870-71. Dr. Herrgolt	3	3
Crimean War, Schmidt's Jahrbücher, Vol. 156, p. 250	8	7
German-French War, " " " " " "	5	4
American Jour. Med. Sci., 1868, pp. 333, 555. Dr. Brinton	68	27
Totals	86	42

Mortality, 49 per cent.

PATHOLOGICAL.

AUTHORITIES.	CASES.	DIED.
Guy's Hospital Reports	1	0
St. Bartholomew's Hosp., 1863-71	6	2
Mass. Gen. Hosp.	11	4
American Jour. Med. Sci., 1868, pp. 333, 555. Dr. Brinton	92	19
British Army Med. Rep.	1	0
Prof. Billroth, Arch. Klin. Chir., B. x.	7	6
Lücke, Deutsch Zeitschrift für Chir., B. ii.	1	0
Totals	119	31

Mortality, 26 per cent.

TIME OR CAUSES IMPERFECTLY STATED.

AUTHORITIES.	CASES.	DIED.
St. George's Hospital, London	7	3
Circular No. 3, Surg. Gen. U. S. Army, Traumatic	3	0
" " 6, " " " " " "	73	51
Bericht. k. k. allg. Krankenhaus, Wien	3	2
Statist. des Hôp. de Paris, 1861-2-3	2	1
Lücke, Deut. Zeitschrift, B. 2	2	1
Zurich Hosp., 1860-67	1	1
Arch. klin. Chir., Bd 17, S. 510	38	11
Totals	129	70

Mortality, 54 per cent.

SUMMARY OF AMPUTATIONS AT THE KNEE JOINT ABROAD.

	CASES.	DIED.	PER CT. MORT.
Primary	206	98	48
Intermediary and Secondary combined.....	86	42	49
Pathological.....	119	31	26
Conditions imperfectly stated, but cases nearly all military	129	70	54

The pathological cases here are nearly all those called by Brinton "secondary pathological;" that is, cases which are more or less chronic. The importance of the distinction is that amputations in the acute inflammatory stage of the knee joint are very fatal, whether performed at the knee or just above it, and should be avoided if possible.

OPINIONS OF AUTHORS.

Amputation at the knee joint, instead of at the lower third of the thigh, was first performed by Fabricius Hildanus, in 1581, and re-introduced to the profession mainly by the efforts of Velpeau, Markoe and Brinton. It was first performed in America by Prof. Nathan Smith.

The operation was at first mainly performed by leaving the condyles in the stump. Mr. Carden, of Great Britain, introduced as an improvement the plan of sawing off the articular portion of the condyles, and the statistics of that country apparently showed about six per cent. more safety by that method, but Dr. Brinton, (*Am. Jour. Med. Sci.*, 1868,) adds the American statistics, which change the result, and render the two methods almost exactly equal, as may be seen in the following figures:

CONDYLES LEFT.		CASES.	DIED.	PR. CT. MORT.
American Cases.....	45	12	27	
Foreign Cases	34	10	29	
Totals.....	79	22	28	
CONDYLES REMOVED.		CASES.	DIED.	PR. CT. MORT.
American Cases.....	19	6	32	
Foreign Cases	13	3	23	
Totals.....	32	9	28	

Dr. Brinton compares the mortality of amputation at the knee joint with that of amputations of the thigh, in order to show that the knee joint is much the safer location. In doing so, however, he commits the mistake of making his comparison with amputations in all parts of the thigh together. This is not fair. Cases which require amputation at the middle and upper thirds of the thigh, do not admit of the knee joint as a substitute. The only thigh amputations which allow the choice are those at the lower third. If now we take our summary of amputations in the lower third abroad, and place them beside the corresponding knee amputations, we get the following result:

	MORTALITY OF AMPUTATIONS.	
	At Lower 3d of Thigh.	At Knee Joint.
Traumatic Primary.....	45 per cent.	48 per cent.
Traumatic Secondary.....	60 " "	49 " "
Pathological	20 " "	26 " "
Averages.....	42 " "	41 " "

The superiority of the knee joint amputation over that at lower third of the thigh averages only one per cent., a difference too small to be trusted, especially as part of the cases are picked up from scattering operations reported in journals, a method of collection which always gives too large a proportion of successful results.

Mr. Liston, in Holmes' System of Surgery, p. 606, praises the operation exceedingly for the small amount of tissue divided, the excellence of the flap, the absence of exfoliation of bone and great length and usefulness of the stump.

T. Holmes (Surgery, its Principles and Practice, p. 923,) says he is "rather fond" of the operation.

Gant's Surgery, p. 706, says the "results with regard to the stump are advantageous."

Gross' System of Surgery, Vol. II., p. 1122, praises the operation because of its length of stump, the fact that it avoids some dangers by not opening the medullary canal, has no exfoliation of bone, and has a low mortality; but he opposes its performance when any point lower down is admissible.

Parker, of New York, in the *New York Journal of Medicine*, Vol. IX., N. S., p. 308, advocates it as "justifiable," and giving a good stump.

Dr. Henry Smith, in his *Operative Surgery*, at first opposed it, but later, in his *Principles and Practice of Surgery*, Vol. II., p. 704, retracted his first opinion, and though still in doubt, inclined to favor it.

Markoe of New York, Brinton of Philadelphia, Erichsen of London, and Von Langenbeck of Berlin, all favor the operation.

Of the older surgeons, Velpeau, Textor, Kern, Volpi, Brasdor, J. L. Petit, Hoin and Blandin advocate the operation; while Dupuytren, Larrey and Zang unconditionally opposed it.

CONCLUSIONS.

It is evident that the mass of the best writers now favor the amputation at the knee joint whenever the condition admits of its being substituted for that of the lower third of the thigh. Its danger is perhaps a little less, and the stump is better. It is therefore to be preferred in such cases. As to the question whether simple disarticulation, or sawing through the condyles is the best, the statistics show the danger to be the same, when the American and Foreign cases are added together. It has been thought that the presence of the cartilage and synovial surface would have some of the same evils which result from opening a knee joint to the air, but experience apparently shows otherwise, or if the presence of those tissues is somewhat objectionable, that danger is balanced by the increased risk of pyæmia induced when the cancellous tissue of the condyles is sawn through.

AMPUTATION OF THE LEG.

Of this very common operation I find the following cases recorded in the Lake States:

TABLE IX.

AMPUTATION OF THE LEG IN THE LAKE STATES.

No. Am- drew's Sur.Rec	OPERATOR.	Age	REASON FOR OPERATION.	COMPLICATIONS.	Operati'n	Cond.	Time to operation.	Result.	Time to death or recovery	Practice.
644	Dr. E. Andrews	35	Both feet crushed.	Mortification	Dbl Amp Middle 3d	Good	-----	Recover'd	8 mos.	Private.
1553	" "	---	Leg crushed by cars.	None	Re-a. up. 3	Good	Primary	Died	30 days	"
1601	" "	---	Neuralgic stump of leg.	Kept in close, foul room.	Middle 3d	Good	Primary	Recover'd	2 "	Hospital.
1857	" "	---	Leg and arm crushed by cars.	Great shock—amp. of arm	Lower 3d	Bad	Primary	Died	6 weeks	"
1943	" "	---	Large ulcer from burn	None	Middle 3d	Good	Primary	Recover'd	10 "	"
3390	" "	---	Fractured leg by cars.	-----	Circ. m. 3d	"	"	"	8 "	"
3392	" "	---	Fractured leg by cars.	-----	Upper 3d	"	"	"	8 mos.	"
3508	" "	---	Foot crushed off	Severe hemorrhage.	Upper 3d	Med.	"	"	5 weeks.	"
5267	" "	---	Leg crushed by cars	Mortification of foot.	Middle 3d	Bad.	3 days	Died	6 days	"
5661	" "	---	Leg crushed by cars	None	Upper 3d	"	Secondary	Recover'd	Private	"
5196	" "	---	Comp. fract. foot & leg. Caries of tibia	None	Upper 3d	"	Several yrs.	"	"	"
6017	" "	---	Caries of tibia.	None	Middle 3d	"	3 weeks	"	"	"
6042	" "	---	Caries of ankle	Calcified arteries, exchans	Cir. low. 3	Good	Primary	Died	3 days	"
6290	" "	---	Comp. fract. of ankle	None	Cir. low. 3	"	"	Recover'd	"	"
---	La Count.	45	Foot and ankle torn badly.	None	" mid. 3	"	"	"	"	"
---	" "	---	Wound of ant. tibial art. Gangrene	Hemorrhage.	" low. 3	Med.	Secondary	"	"	"
---	" "	---	Comp. fract. tibia and fibula.	None	Flap low 3	"	Primary	"	6 weeks	Hospital.
6600	E. Andrews	25	Diseased foot from injury.	None	Circ.	"	Primary	"	22 "	"
6975	" "	62	Comp. and commin. fract. of leg.	Weak with age	Flap up 3	Bad	1 month	Died	5 days	"
7012	" "	30	Both feet crushed.	Great shock	" low. 3	"	Primary	Recover'd	1 "	Private.
---	D. Brainard	12	Caries of ankle	-----	Lower 3d	"	Primary	"	36 days	Hospital.
---	" "	---	Comp. fract. of ankle	-----	Flap up. 3	"	"	"	6 hours	Private.
---	Annerman	53	Necrosis of tibia and fibula.	Great shock, ampt. of arm	Upper 3d	Bad.	4 hours	Died	12 "	"
---	A. Fisher.	45	Comp. and commin. fract. leg & arm	-----	"	Med.	Primary	Recover'd	"	Hospital.
---	E. Owens	20	Comp. and commin. fract. leg. R. R.	-----	"	"	Secondary	"	"	"
---	" "	---	R. R. fracture.	-----	"	"	Primary	"	"	"
---	" "	---	Disease of parts	-----	"	"	Secondary	"	"	"
---	Cook Co. Hosp.	---	-----	-----	Middle 3d	"	"	"	"	"
---	" "	---	-----	-----	Lower 3d	"	"	Died	"	"
---	" "	---	-----	-----	"	"	"	"	"	"
---	H. Wardner.	17	Leg crushed by falling tree.	Shock and contusion of	Upper 3d	Bad.	Primary	"	4 days	Private.
---	" "	---	Leg crushed on R. R. and fract. elbow	Shock	Middle 3d	Med.	"	Recover'd	2 mos.	"
---	" "	---	Foot and ankle crushed by boats.	Shock and hemorrhage.	Lower 3d	"	"	"	6 weeks	"

TABLE IX.—Continued.

Dr.	N. Senn	Shock and hemorrhage.	Lower 3d	6 hours	Recover'd	6 weeks.	Private
"	"	10 Ankle cut by reaper	"	Bad	---	4	"
"	"	28 Caries of ankle and tarsus fr. injury	Circ.m.3d	8 hours	"	4	"
"	"	21 Leg crushed by runaway	Upper 3d	3 days	"	6	"
"	H. Wardner	25 Ankle cut by axe	Middle 3d	1 year	"	21 days	"
"	"	32 Caries of ankle	Upper 3d	Primary	"	3	"
"	M. W. Waterhouse	12 Leg crushed by car wheels	"	Bad	Died	---	"
"	"	73 Leg crushed by wagon wheels	"	"	Recover'd	---	"
"	"	16 Leg torn by threshing machine	"	"	"	---	"
"	E. D. Kittoe	42 Bad comp. and commin. fract. of leg	"	Good	"	---	"
"	"	40 Leg torn by threshing machine	"	Bad	"	---	"
"	E. Kittoe, Jr.	42 Bad comp. and commin. fract. of leg	"	Good	"	---	"
"	J. Andrews	15 Comp. fract. of leg	"	Bad	"	---	"
"	"	30 Comp. fract. of leg	"	Good	"	---	"
"	E. W. Lee	8 Comp. fract. of leg	Flap up, 3	Primary	Died	15 days	"
"	"	22 Comp. fract. of leg	"	"	Recover'd	24 hours	"
"	"	9 Comp. fract. of leg	"	"	"	14	"
"	"	25 Comp. fract. of leg	"	"	Died	10 days	"
"	"	45 Comp. fract. of leg	"	"	"	5	"
"	"	22 Feet crushed by cars	"	Bad	"	48 hours	"
"	E. Andrews	22 Feet crushed by cars	"	"	"	---	"
"	"	27 Annular varix of anterior tibial vessels, caused by scythe when 13	Lower 3d	Bad	Recover'd	---	Hospital.
"	S. Marks	60 Caries of the tarsus	Upper 3d	Good	Died	9 days	Hospital.
"	"	8 Gangrene of foot after R. R. accident, fracture of the other leg	Low 3flap	Med.	Recover'd	8 weeks	"
"	"	58 Caries of the tibia	"	Bad	"	4	"
"	"	19 Disease of ends of bones, following primary amputation of leg	Upper 3d	Good	"	---	Private
"	"	9 Both ankles crushed by locomotive	Mid.3 flap	"	"	8	Hospital.
"	"	41 Both feet frozen. Drunk	Low 3flap	Med.	"	4	Private
"	"	30 Foot and ankle crushed by locomotive	Mid.3 flap	Bad	"	8	Hospital.
"	"	23 Foot crushed by cars	Low 3flap	Good	"	8	Private
"	"	38 Caries of tarsus	"	"	"	8	"
"	"	20 Leg cut off with steamboat cable immediately above ankle	"	"	"	3 mos.	Hospital.
"	"	32 Foot and low. port. of tibia crushed	"	"	"	4 weeks	"
"	"	58 Caries of tarsus	Mid.3 flap	Med.	"	6	Private
"	"	33 Caries of tarsus and lower end tibia	Mid.3 flap	"	"	9 years	"
"	"	19 Caries of tibia	Upper 3d	Bad	"	6 mos.	"
"	"	43 Caries of tarsus	Low 3flap	"	"	3 mos.	Hospital.
"	"	42 Caries of tarsus	"	Bad	Died	17 days	Private

RECAPITULATION.

	CASES.	DIED.	PER CENT. MORTALITY.
Total of all locations	70	16	23
“ upper 3d.	22	8	36
“ middle 3d.	16	4	25
“ lower 3d.	23	3	13
Primary, all locations	32	9	28
Intermediary and secondary, all locations	16	3	19
Pathological, all locations	13	3	23
Upper 3d, primary	13	6	
“ intermediary and secondary combined	4	1	
“ pathological	5	1	
Middle 3d, traumatic and primary	7	2	
“ intermediary and secondary combined	6	1	
“ pathological	3	1	
Lower 3d, traumatic, primary	12	1	
“ intermediate and secondary combined	6	1	
“ pathological	5	1	
Conditions imperfectly stated	9	1	
Hospital practice	28	5	18
Private practice	41	11	27

These cases are not sufficiently numerous to settle all points, but they show that, like amputations of the thigh, those nearest the body are most dangerous. The upper 3d has a mortality of 36 per cent., the middle of 25 per cent., and the lower 3d of 13 per cent.

Hospital cases, by some accidental coincidence show better than those in private practice.

AMPUTATIONS OF THE LEG ABROAD.

Of these the literature of surgery furnishes a prodigious list, and, were they properly classified, they would settle nearly all questions capable of statistical solution. Unfortunately they are very imperfect in detail, and only a portion of them can be classified.

AMPUTATION OF THE LEG ABROAD; UPPER 3D, PRIMARY.

AUTHORITIES.	CASES.	DIED.
Rept. Boston City Hosp., Dr. Cheever	4	2
Mass. Gen. Hosp. Rept., 1871	26	7
Dr. Herrgolt, Siege of Strassburg, 1870-71	14	5
Warren's Surgery, Confed. Army Rept.	41	17
Totals	85	31

Mortality, 36 per cent.

AMPUTATION OF THE LEG ABROAD; UPPER 3D, INTERMEDIARY AND
SECONDARY COMBINED.

AUTHORITIES.	CASES.	DIED.
Rept. Boston City Hosp., Dr. Cheever	1	0
“ Mass. Gen. Hosp., 1871	13	4
Dr. Herrgolt, Siege of Strassburg, 1870-71	6	3
Dr. E. Warren's Surg., p. 394, Confederate Army U. S.	33	18
Totals	53	25

Mortality, 47 per cent.

AMPUTATION OF THE LEG ABROAD; UPPER 3D, PATHOLOGICAL.

AUTHORITIES.	CASES.	DIED.
Rept. Bost. City Hosp., Dr. Cheever	1	1
“ Mass. Gen. Hosp.,	42	7
“ Rostock Hosp. Rep	4	2
Statist. des Hôpitaux de Paris, 1861-62-63.	15	9
Totals	62	19

Mortality, 31 per cent.

AMPUTATION OF THE LEG ABROAD; MIDDLE 3D, PRIMARY.

AUTHORITIES.	CASES.	DIED.
Rept. Boston City Hosp., Dr. Cheever	9	5
“ Mass. Gen. Hosp., 1871	47	19
“ U. S. Marine Hosps., Dr. Woodworth	1	1
Dr. Herrgolt, Siege of Strassburg, 1870-71	2	0
Dr. E. Warren's Surg., p. 394, Confederate Army U. S.	8	5
Totals	67	30

Mortality, 45 per cent.

AMPUTATION OF THE LEG ABROAD; MIDDLE 3D, INTERMEDIARY
AND SECONDARY COMBINED.

AUTHORITIES.	CASES.	DIED.
Rept. Boston City Hosp., Dr. Cheever	3	1
“ Mass. Gen. Hosp., 1871	20	8
Dr. Herrgolt, Siege of Strassburgh, 1870-71	1	1
Dr. E. Warren's Surg., p. 394, Confed. Army	3	2
Totals	27	12

Mortality, 44 per cent.

AMPUTATION MIDDLE 3D OF LEG ABROAD, PATHOLOGICAL.

AUTHORITIES.	CASES.	DIED.
Rept. Boston City Hosp., Dr. Cheever	3	0
" Mass. Gen. " 1871.....	46	3
Totals.....	49	3

Mortality, 6 per cent.

AMPUTATION LOWER 3D OF LEG ABROAD, PRIMARY.

AUTHORITIES.	CASES.	DIED.
Rept. Boston City Hosp., Dr. Cheever	3	0
" Mass. Gen. Hosp., 1871	20	7
Dr. Herrgolt, Siege of Strassburg, 1870-71.....	2	1
Leeds Gen. Infirmary, Dr. Nunneley.....	69	28
Dr. E. Warren's Surg. Confederate Army, p. 394.....	5	1
Totals.....	99	37

Mortality, 37 per cent.

AMPUTATION OF LOWER 3D OF LEG ABROAD, INTERMEDIARY AND SECONDARY COMBINED.

AUTHORITIES.	CASES.	DIED.
Rept. Boston City Hospt.....	6	1
" Mass. Gen. Hosp. 1871.....	15	5
" U. S. Marine Hosp.....	2	0
Dr. Herrgolt, Siege of Strassburg, 1870-71.....	2	1
Dr. E. Warren's Surg., p. 394, Confederate Army.....	6	2
Totals.....	31	9

Mortality, 29 per cent.

AMPUTATION OF THE LOWER 3D OF LEG ABROAD, PATHOLOGICAL.

AUTHORITIES.	CASES.	DIED.
Boston City Hospt. Rep.....	1	0
Rostock Hospt. Rept.....	2	0
Mass. Gen. Hosp. Rept. 1871.....	28	5
Totals.....	31	5

Mortality 16 per cent.

AMPUTATION OF THE LEG ABROAD, IMPERFECTLY CLASSIFIED.

AUTHORITIES.	CASES.	DIED.
Circular No. 6, Surg. Gen. U. S. A.	2348	611
Statistics of Crimean War	1361	940
“ Italian War	475	326
“ German-French War	141	70
British Country Hospitals	838	177
St. Bartholomew's Hosp., 1869	193	61
K. k. allg. Krankenhaus Bericht, Wien	241	71
Leeds General Infirmary	99	15
Parisian Hospitals	266	160
Edinburg Infirmary, 1859 to 1868	86	38
Glasgow “ 1844 to 1868	180	77
Guy's Hospital, 1861 to 1868	102	36
London “ 1862 to 1868	67	39
Combined Reports from various authors	558	212
Totals	6955	2833

Mortality, 40 per cent.

GENERAL SUMMARY OF AMPUTATIONS OF THE LEG.

TOTALS.	LAKE STATES.			ABROAD.		
	CASE	DIED	PER CT. MORT	CASE	DIED	PER CT. MORT
Total of all kinds	70	16	23	7459	3004	40
“ private practice	41	11	27			
“ hospital “	28	5	18			
“ upper 3d	22	8	36	200	75	38
“ middle 3d	16	4	25	143	45	31
“ lower 3d	23	3	13	161	51	32
Upper 3d, primary	13	6		85	31	36
“ intermediary and secondary	4	1		53	25	47
“ pathological	5	1		62	19	31
Middle 3d, primary	7	2		67	30	45
“ intermediary and secondary	6	1		27	12	44
“ pathological	3	1		49	3	6
Lower 3d, primary	12	1		99	37	37
“ intermediary and secondary	6	1		31	9	29
“ pathological	5	1		31	5	16

The small proportion of perfectly classified statistics renders this summary a little irregular, but still it shows the general decrease of danger as we recede from the body, and the superior safety of pathological amputations (those of “ expediency ” always excepted) over traumatic cases.

OPINIONS OF AUTHORS AND CONCLUSIONS.

Authors say very little about the special indications demanding amputation of the leg. In general terms they are such as demand amputation in any other part of the body. The surgeon must not be swayed, as is too often the case, by the ghastly appearance of a bad compound fracture, but consider the intrinsic condition of the limb as to circulation and innervation. If these functions are fairly preserved, a great amount of bony injury can be successfully overcome. In war a bullet traversing from before backward may shatter the tibia, bury a hundred of its fragments in the tissues of the calf, and destroy the posterior tibial artery and nerve, and yet the wound make no great external display. On the other hand, if the ball traverse from behind forward, the artery and nerve may escape, and the fragments of bone be driven out into the external air in front. The wound is large, ragged, and terrible to the eye, but much less dangerous than the former. Yet many a surgeon, in looking over his patients, has been moved by mere external appearances to amputate the better limb and try to save the worse one. Analogous errors are common in civil practice.

A mere bad compound fracture does not necessarily require amputation. Compound dislocations of the ankle often require resection, but rarely amputation. It is much disputed whether it is best to amputate anywhere for senile gangrene in the foot. If, however, it is decided to be best, the amputation should be at least as high as the upper third of the leg, and not in the foot. Some advise the lower third of the thigh.

Where the injury or disease requiring amputation of the leg admits of a choice of location, all authors agree that it should be as low down as possible, in order to reduce the risk to the lowest attainable figure. In the leg, as well as elsewhere, amputations of "expediency," *i. e.*, for deformities, etc., have the general risk of traumatic, and not the slighter one of pathological cases.

In compound fractures and dislocations of the ankle joint, amputation should not be performed unless mortification of

the foot or other imperative reasons demand it. Resection has the best results in those cases, conservative treatment next, and amputation the worst.

SYME'S AMPUTATION AT THE ANKLE.

I have not obtained a single recorded case of this operation in the Lake States, but the literature of the profession gives us many cases from abroad, though generally not classified. They are as follows:

AUTHORITIES.	CASES.	DIED.
Deutsch Zeitschrift, für Chir. Bd. I. und II.	3	0
Dr. Herrgott, Seige of Strassburg, 1870-71.	2	1
Dr. E. Warren's Surg., Confederate Army.	2	1
Hancock.	219	17
Birmingham Hospt. 1858-64, Richardson.	45	7
Rostock Hospt. Rept. 1868.	6	1
Brit. Army Med. Rep.	2	0
Archiv. Klin. Chir. Bd. X, Billroth.	2	0
" " " " X, XIII and XVII.	44	3
Totals.	325	30

Mortality, 9 per cent.

We will discuss the merits and opinions on this operation at the same time with the next one.

PIROGOFF'S AMPUTATION.

Of this we find in the Lake States quite a number of cases which are given below:

TABLE X.
PIROGOFF'S AMPUTATION IN THE LAKE STATES.

No.	OPERATOR OR REPORTER.	CAUSE OF OPERATION.	COMPLICATIONS.	Opera- tion.	Con- dition	Time of operation	Result.	Time to death or recovery.	Practice.
1866	Dr. E. Andrews	Both feet frozen.	Both feet amp. at once.	Pirogoff's	Good	Secondly.	Died.	16 days	Hosp
2063	" "	Foot crushed.	Intemperate	"	Med.	Primary	"	51 days	"
5428	" "	" "	"	"	Good	"	Recovery	3 months	"
5084	" "	" "	None	"	"	13 days	"	4 1/2 ms.	"
3239	" "	and mortified.	"	"	"	Primary	"	2 1/2 ms.	"
1967	H. A. Johnson	" "	"	"	"	18 ms.	"	12 ms.	"
8459	E. Andrews	Caries of tarsus	None	"	"	Primary	"	"	"
8518	" "	Foot crushed.	"	"	Med.	Primary	"	"	"
---	J. S. Sherman	" "	Op. leg cr. and amp. 10 d.	"	"	10 days	"	"	"

RECAPITULATION.

	CASES.	DIED.
Total (all Hospital patients)	9	2
Primary	5	1
Secondary and intermediary	3	1
Pathological	1	0

Total mortality in the Lake States, 22 per cent.

The cases are not numerous enough to furnish by themselves any special conclusions.

Abroad the literature furnishes us a moderate number, mostly unclassified.

PIROGOFF'S AMPUTATION. ABROAD.

AUTHORITIES.	CASES.	DIED.
Penn. Hosp.	2	0
St. George's Hosp.	2	1
Rostock Hospt. Rept.	4	1
Dr. E. Warren's surg., p. 394, Confederate Army	1	0
Bericht k. k. allg. Krankenhaus, Wien	26	9
Braithwaite's Retrospect, Jan. 1867	58	5
Archiv. klin. Chir. Bd. X., Billroth	11	4
" " " " VIII	1	0
Deutsch. Zeit. f. Chir. B. I, S. 187; B. II., S. 380	7	0
Totals	112	20

Mortality, 18 per cent.

OPINIONS OF AUTHORS.

Syme's and Pirogoff's amputations are rivals of each other, being applied to the same class of cases.

The American Surgeon General's Circular, No. 6, says that Pirogoff's operation is regarded with little favor.

Baron von Horrowitz, the Surgeon-in-Chief of the Russian Marine, says that Pirogoff himself has abandoned it on account of the frequent occurrence of necrosis of the os calcis.

Dr. Stephen Smith says the stump of Syme's operation is better than that of Pirogoff.

Hewson, on the contrary, (quoted in Ashurst's Surgery, p. 122,) says that Pirogoff's stump has some decided advantages over Syme's, in that the patient can walk and run upon it.

Liston, in Holmes' System of Surgery, Vol. V., p. 644, prefers Syme's amputation as simpler, easier, and less liable to caries.

Gant's Surgery, p. 701, says this liability to caries is not present in traumatic cases.

Erichsen's Surgery, Vol. I., pp. 78, 79, speaks favorably of Pirogoff's operation, and thinks the objections to it not very well grounded in experience.

Gross' Surgery, Vol. II, p. 1119, prefers amputation of the lower 3d of the leg to either Pirogoff's or Syme's operation.

Dr. Stephen Smith, on the contrary, in his contribution to the papers of the United States Sanitary Commission, concludes that Syme's amputation is 50 per cent. safer than that at the lower 3d of the leg.

Hamilton's Surgery, p. 368, says that the stump in both Pirogoff's and Syme's operation is often most excellent.

Bryant's Surgery, p. 964, speaks in the highest terms both of Pirogoff's and Syme's amputations.

CONCLUSIONS

As usual, the opinions of surgeons are a little contradictory of each other, yet the majority favor Syme's rather than Pirogoff's method. The statistics, though less perfect than could be desired, still point to the same conclusion, for we have as follows:

	CASES.	DIED.	MORTALITY.
Syme's amputation.....	325	30	9 per ct.
Pirogoff's ".....	112	20	18 " "

It would appear, therefore, that thus far Pirogoff's operation has had double the mortality of Syme's, an important fact scarcely referred to by our best authors.

It is evident, therefore, that as facts and opinions now appear, they compel us to consider Syme's operation as much the best.

The military statistics of Demme, Stromeyer and Legouest, give for compound fractures of the foot much better results

for conservative treatment than for any kind of amputation. The superiority of their conservative figures varies from 28 to 59 per cent.

It would seem, therefore, that an amputation of the foot is not demanded for ordinary bad compound fractures, but only for that portion of them where there is such an amount of mortification as compels it.

OTHER AMPUTATIONS OF THE FOOT.

I have included these all in a single table, which is here subjoined:

TABLE XI.

AMPUTATIONS THROUGH TARSUS AND METATARSUS IN LAKE STATES, (EXCLUDING PIROGOFF'S AND SYME'S.)

No.	OPERATOR OR REPORTER.	Age.	CAUSE OF OPERATION.	COMPLICATIONS.	OPERATION.	Con- diti'n	Time of operation	Result.	Time to death or recovery	Time to death or recovery
6654	Dr. E. Andrews	24	Crushed toes		In metatarsus	Good	12 days	Recov'r'd	6 weeks.	Hospital.
5129	"	--	Both feet frozen		At juncture of tarsus and metatarsus of both feet.	"	Second'y.	"	3 mos. --	"
	"	--	Fracture of both feet		At juncture of tarsus and in tarsus of both feet.	"	"	"	"	"
	" Hyde	32	Feet frozen	None	Junct. tarsus & metatarsus	Med	"	"	1 month	"
	" E. Owens	--			Chopart's in one foot and Hey's in the other.	"	"	"	"	"
	" H. Wardner	24	Frost bite	Drunk	Both feet through metatar.	Bad	Primary	"	3 mos. --	Private.
	"	18	Foot crushed	None	Chopart's	Good	"	"	4 " --	"
	"	16	" " on R. R.	Consider'ble shock	"	"	"	"	5 " --	"
	"	12	" " "	"	"	"	"	"	6 " --	"
	"	30	Feet frost bitten and mortified.		Metatarsus of one foot and all the toes of the other.	Med	"	"	"	"
	" E. D. Kittoe	22	Foot cut off by axe	Great shock.	Chopart's	Bad	8 days	Died	3 days	"
	"	23	Foot crushed by stone.	Up. & lo. jaws fract.	"	Good	3 days	Recov'r'd	"	"
	" J. Andrews	30	Wound of dorsal artery of foot.	Caries of foot.	"	Med	6 hours	"	"	"
	" E. W. Lee.	19	Foot crushed by R. R.	"	"	Bad	Second'y.	"	"	"
	"	18	" " "	"	Metatarso-phalangeal arti- culation	Good	4 hours	"	4 weeks.	"
	"	24	" " "	"	Chopart's	"	3 hours	"	5 " --	"
	" S. Marks	24	" " "	"	"	"	Primary	"	2 mos. --	Hospital.
	"	31	" " "	"	"	"	"	"	3 " --	Private.

RECAPITULATION.

	CASES.	DIED.	PER CENT. MORTALITY.
Total of all kinds.....	17	1	6
Total Chopart's amputation.....	10	0	0
Chopart's primary.....	7	0	0
" intermediary and secondary.....	3	0	0
Junction of tarsus and metatarsus.....	3	0	0

CHOPART'S AMPUTATION ABROAD.

The few published statistics of this operation are imperfectly classified. Of 101 cases of all kinds, sixteen died, which is about sixteen per cent., while of our ten cases recorded in the Lake States none died.

OPINIONS OF AUTHORS.

As above stated, Demme, Stromeyer and Legouest show military statistics to the effect that in compound gunshot fractures of the foot, conservative treatment is better by a large figure than any amputation.

Holmes' System of Surgery, Vol. V., p. 642, says Chopart's amputation is "undesirable," on account of the tendency of the stump to point its extremity too much downward.

Erichsen, Vol. I., p. 73, thinks that Hey's amputation at the tarso-metatarsal articulation is often not desirable, and prefers if possible to saw through the metatarsals in front of the joint. In respect to Chopart's amputation he, contrary to Holmes' opinion, says that the stump is excellent, and that if it points too much downward it should be remedied by division of the tendon of Achilles. He advises to saw off the head of the astragalus, and the articular surface of the os calcis.

GENERAL EFFECTS OF AGE, SEX, TIME OF OPERATION, AND PATHOLOGICAL CONDITION ON THE MORTALITY OF AMPUTATIONS.

These topics are as yet very imperfectly investigated, owing to the present rude condition of the science of statistics. Some dim light, however, has been thrown on them.

AGE.—Malgaigne's statistics of the Hospitals of Paris give the following conclusions:

1. Under five years of age the mortality of amputations is more than between five and fifteen years.

2. From five to fifteen years is the most favorable age.

3. From fifteen to twenty years the risk increases.

4. From twenty to fifty years it remains nearly stationary, but increases again after fifty. (*Dictionnaire des Sciences Médicales.*)

Mr. Callender, of St. Bartholomew's Hospital, London, says that in that institution the death of a child or of a patient under the age of forty is an exception, and that age increases the tendency to death.

From 1853 to 1863 the mortality of primary amputations all ages was less than ten per cent., while of ten cases over sixty-five years of age, sixty per cent. died. The experience of St. Bartholomew's Hospital is very valuable, because it is of all the hospitals in the world perhaps the most free from septic hospital contamination. (*Med. and Surg. Trans.*, Vol. XLVII., p. 75, 1864.)

It is probable that amputation at the hip joint, and at the upper part of the thigh, will be found to undergo a great increase of danger at the age of puberty, when the pelvic organs assume their adult development. This rule probably applies to all operations and injuries to the pelvis and the parts immediately adjacent.

SEX.—The opinions and figures on the influence of sex are in utter contradiction to each other, showing the present unfinished state of our knowledge on plain points which ought long ago to have been well settled. The *Dictionnaire des Sciences Médicales*, in the article on amputations, says that women bear amputations better than men, and cites in proof, the statistics of Newcastle, Glasgow, Edinburg and Paris, summed up as follows:

	CASES.	DIED.	PER CENT. MORTALITY.
Amputations in males.....	1244	441	35
“ in females	284	83	29

On the opposite side, Mr. Callender (*Med. and Surg. Trans.*,

1864,) says that the mortality of the operation among women is worse by fifty per cent. or more than among men.

Schmidt's *Jahrbücher* says that at Jenna the mortality of certain amputations was $21\frac{3}{4}$ per cent. worse among the women than among the men.

There is no reconciling such absolute contradictions. All we can say is that at present the influence of sex on the mortality has not been properly determined.

TIME OF OPERATION.—Here we are met again with irreconcilable contradiction. Dr. Ashurst, of Philadelphia, has tabulated in his *Surgery*, p. 110, 2,201 cases from the civil hospitals of both continents, showing primary amputations of all kinds as having a mortality of 32 per cent., and secondary ones of 50 per cent. The statistics of military amputations in the Crimean and American wars show a similar result.

On the other hand, the *Dictionnaire des Sciences Médicales*, tome III., p. 770, gives figures which foot up as follows:

	CASES.	DIED.	PER CENT. MORTALITY.
Primary amputations of all kinds.....	5599	3164	56.51
Secondary " " "	2265	1290	56.95

These statistics show the primary and secondary cases to have almost exactly the same mortality.

The usual assertion of authors is that, in general, primary amputations are safer than secondary, but that at the hip and in the upper half of the thigh secondary ones are the safest.

The greater danger of primary than of secondary amputations at the hip and upper part of the thigh, is established, at least in adults. It is not proved, nor provable in children, who bear operations about the hips much better than adults; but the vast mass of figures above quoted show that, taking all kinds together, primary amputations have scarcely a shade of superiority over the secondary, a result in bold contradiction to the opinions taught by nearly all authors.

INTERMEDIARY AMPUTATIONS.—Military surgeons divide the cases ordinarily called secondary into two parts, those per-

formed after the first 24 hours, and before the establishment of free suppuration, being separated from the remoter secondary, and termed *intermediary*. These are considerably more fatal than either primary or secondary operations, except in the case of the hip joint. At that articulation every stage is safer than the primary.

The underlying principle appears to be that the presence of acute inflammation is a source of greatly increased danger, and large operations should be avoided if possible during its existence.

PATHOLOGICAL CONDITION.—Here is a wide field of investigation, which has been only imperfectly explored. Traumatic amputations on the average are much more fatal than those performed for disease. Ashurst's table (Surgery, p. 109,) collates over 4,000 cases of all kinds, and gives

Mortality of traumatic amputations. . . . 41 per cent.

“ “ pathological “ . . . 30 “

But all traumatic cases are not alike. Those which have produced a chronic trouble of many months' duration, often become to all intents and purposes like pathological cases.

In suppurating knee joints, both traumatic and pathological, the acute stage of the inflammation is an excessively dangerous time for amputation, and is to be avoided by all possible means.

Amputations of “complaisance,” or “expediency,” so-called, that is, amputation of members otherwise healthy, but simply deformed, though technically classed as pathological, have not the safety of other pathological cases. Their rates of mortality are almost the same as those of traumatic cases.

Cancer, necrosis, caries of joints, etc., are pathological conditions often demanding amputation, and the danger of one perhaps differs from that of another, but the literature of the profession gives only an obscure light respecting it. At present we know little of the difference, but only the general fact that taken together, amputations for these causes are much safer than those performed for traumatic causes.

FLAP OR CIRCULAR OPERATIONS.—Efforts were formerly made to show statistically an advantage of one or the other

methods, but the results were contradictory, and with the multiplication of new plans the old discussion between the advocates of flap and circular amputations died out, without any decided superiority being shown for either. At the present day surgeons selecting one or the other method, do it on other grounds than any supposed general difference of mortality between them.

INDICATIONS FOR AMPUTATION.—The Dictionnaire des Sciences Médicales (Article Amputation,) sums up the indications with excellent judgment, and substantially as follows:

Pathological Causes.—1, irremovable cancer; 2, diseases of bones not otherwise removable; 3, caries of joints after white swelling (this does not always require it); 4, diffuse aneurism, threatening gangrene, not amenable to ligation; 5, other aneurisms disorganizing parts too seriously to admit of cure by ligature, etc.

Traumatic Causes.—6, tearing off of limbs; 7, crushing of both bones and soft parts to disorganization; 8, comminuted fractures, with destruction of the great nerves at the root of the limb; 9, wounds of large joints not admitting of resection and extensive injury of coverings; 10, compound dislocations with great destruction of soft parts and principal vessels; 11, very destructive burns; 12, traumatic gangrene.

Surgeons should carefully avoid the vulgar error of being influenced by the external appearance of the wound, instead of the condition of the parts, and the state of the innervation and circulation.

RESECTIONS.

Of these important operations I find a considerable number of records; several of which are derived from a valuable report of Dr. Henry Lyster to the Michigan State Medical Society:

TABLE XII.
EXCISIONS OF LARGE JOINTS AND BONES IN THE LAKE STATES.

NO.	OPERATOR.	AGE	REASON FOR OPERATION.	COMPLICATIONS.	OPERATION.	Cond. at opr.	Time to Operation.	Result.	Time to death or recovery.	Practice.
7054	Dr. E. Andrews	14	Caries of ankle.	None	Excision of ankle	Good	several yrs.	recovered		Hospital.
7310	"	55	Deformity of ankle fr. injury	"	" elbow	"	primary	"		Private
7312	"	40	Comp. fracture of elbow.	"	" ankle	"	2 yrs.	"		"
---	"	7	Caries of ankle.	"	" knee.	Bad.	2 weeks.	died	10 days.	"
---	"	45	Caries of knee (recent)	"	" shoulder.	Med.	some "	recovered		Hospital.
6461	"	25	" knee	"	" knee.	"	"	"		"
518	"	23	" shoulder	"	Exc. np. 3 1/4 in. humerus	"	2 yrs.	failed		"
---	"	---	" knee	"	" of knee.	"	"	recovered	some ms.	"
5541	"	19	" tarsal bones.	"	" of ant. tarsals.	Good	some ms.	"		"
6682	"	37	Talipes varus	"	" of ankle.	"	6 yrs.	died	4 weeks.	"
483	"	22	Hip dis. and caries of ankle	Abscess at ankle	" head of femur	Bad.	secondary	recovered	8 mos.	Private
1977	"	20	Caries of ankle after fract.	None	" of ankle	"	some mos.	"	2 yrs.	Hospital.
---	"	7	"	"	" head of femur	"	7 yrs.	died	10 mos.	Private
374	"	11	Hip disease and caries	"	" hd. & trochanter fem.	"	2 yrs.	"		"
648	"	13	"	Tuberculous family	" head and part trochanter of femur	"	"	recovered	8 mos.	"
662	"	6	"	None	Exc. head of femur	Good	2 yrs.	"	4 mos.	"
649	"	6	Hip disease, carious.	None	"	"	2 yrs.	recovered	4 mos.	"
661	"	13	"	Cachexy following diphtheria.	part of trochanter.	Bad.	1 year	died	4 weeks.	"
---	"	---	"	None	Exc. head of femur	Med.	6 mos.	recovered	7 mos.	Hospital.
536	"	6	Hip disease, carious.	None	"	"	several mos	died	5 days.	"
5688	"	25	Hip disease, carious.	None	2 in. of trochanter	Bad.	3 yrs.	"	4 mos.	Private
---	Dr. J. S. Shorman	18	"	"	Exc. hd. fem. & trochant.	"	9 mos.	recovered	4 mos.	Hospital.
---	" Bogue,	26	"	"	Exc. head of femur.	"	"	"		Private
---	" D. Brainard	8	"	"	"	"	"	"		"

TABLE XII.—Continued.

1532	Dr. E. Andrews...	Caries of knee	None	Exc. of knee.	Med	1 year	died	5 weeks	Private
7543	" " " "	Car. head humerus, gunshot	"	" knee	"	18 mos.	recovered	"	"
	" " " "	Diseased knee	"	" "	"	"	"	"	"
	" " " "	" "	"	" "	"	"	"	"	"
	" " " "	" "	"	" "	"	"	"	"	"
60	" " " "	Tumor of upper jaw	"	" entire jaw	"	"	died	"	"
	" " " "	" "	"	" "	"	"	recovered	"	"
30	" " " "	" "	"	" "	"	"	"	"	"
50	" A. Fisher...	Caries of elbow	Syphilitic	" elbow joint	Good	4 years	"	"	Private
	" J. E. Owens...	Hip disease	"	" hip joint	"	"	"	"	Hospital
	Cook Co. Hospital.	Disease of lower jaw	"	" nearly entire jaw	"	"	"	"	"
10	Dr. N. Seim...	Hip disease	"	" hip joint and 4 1/2 in. of femur	"	"	died	"	"
26	Dr. H. Wardner...	Osteo-sarcoma lft sup. max	"	" left sup. maxilla	Bad	16 mos.	recovered	3 mos.	Private
17	Dr. E. " "	Neoplasia of tibia	None	" shaft of tibia	Good	18 mos.	"	5 weeks	"
12	" " " "	" of lower jaw	"	" half the body of	Bad	3 years	"	"	"
	" " " "	" "	"	" lower jaw	Med	2 years	"	"	"
11	Dr. E. D. Kitcoe...	Neerosis of lower jaw	None	" "	Bad	18 mos.	"	"	"
35	" M. Gunn...	Caries of head of humerus	"	" head & 3 in hum's	Good	many mos.	"	"	"
37	" J. H. Beech...	" "	"	" hd. & troch. femur	Bad	some years	died	"	"
8	" T. A. McGraw...	" "	"	" "	Med	"	recovered	"	Hospital
5	" H. F. Lyster...	" "	"	" "	Good	"	"	"	"
7	" " " "	" "	"	" "	Good	"	"	"	"
11	" J. F. Miner...	" "	"	" head and part of	Good	"	"	"	"
	" " " "	" "	"	" trochanter of femur	Bad	"	"	"	"
9	Dr. D. O. Farrand...	Caries of hip joint	"	" trochanter of femur	"	"	"	"	"
	" " " "	" "	"	" "	"	"	"	"	"
848	Dr. E. Andrews...	Caries of ankle joint	None	Exc. ankle joint	Med	"	died	10 days	Hospital
8598	" " " "	" of shoulder, stabbed	"	" "	"	"	recovered	"	"
7794	" " " "	Comp. fract. ankle	Contus. Intern.	" shoulder joint	Bad	30 hours	died	"	Private
7823	" " " "	Commun. sup g fract. ankle	None	" ankle joint	Good	4 weeks	recovered	"	"

RECAPITULATION.

	CASES.	DIED.	PER CENT. MORTALITY
Resection of the shoulder joint.....	5	0	
“ “ elbow “	2	0	
“ “ hip “	19	8	42
“ “ knee “	8	3	37
“ “ ankle “	9	1	11
“ of other parts.....	8	1	12
Totals.....	51	13	25

PRIMARY RESECTIONS OF THE SHOULDER JOINT ABROAD.

AUTHORITIES.	CASES.	DIED.
Med. and Surg. Hist. War of Reb'n, part II., vol. II. p. 599.....	515	160
St. George's Hosp., London.....	1	1
Circular No. 6, Surg. Gen. U. S. A.....	210	50
Gant's Surgery, p. 672.....	59	18
Chisholm's Mil. Surg., Confed. Amer. Army.....	41	13
Deutsch. Zeit. Chir. Bd. 1, 2 und 5.....	15	8
Jahresbericht gesamt, Med. Bd. 2, p. 874.....	1	1
Warren's Surg., Confed. Amer. Army.....	3	1
Totals.....	845	252

Mortality of primary cases, 30 per cent.

INTERMEDIARY RESECTION OF THE SHOULDER ABROAD.

AUTHORITIES.	CASES.	DIED.
Med. Surg., Hist. Rebellion, part II., vol. II., p. 599.....	120	104

Mortality of intermediary cases, 46 per cent.

INTERMEDIARY AND SECONDARY CASES COMBINED; ABROAD.

AUTHORITIES.	CASES.	DIED.
Med. and Surg. Hist. War of Reb'n, part II., vol. II., p. 599.....	316	131
Gant's Surgery, p. 672.....	34	6
Chisholm's Mil. Surg. Amer. Confed. Army.....	29	7
Warren's Surgery, “ “	2	1
Arch. klin. Chir., Bd., 10 und 13.....	4	1
Deutsch. Zeit. Chir., Bd. 1, 2 und 5.....	49	13
Billroth's Briefe.....	6	2
Dr. Herrgolt, Seige of Strassburg.....	3	1
Totals.....	443	162

Mortality, 37 per cent.

PATHOLOGICAL RESECTION OF THE SHOULDER; ABROAD.

AUTHORITIES.	CASES.	DIED.
Gant's Surgery, p. 657.....	80	15
Archiv. klin. Chir. Bd. VIII., S. 106, Bd. X., S. 892, 1893.....	9	2
Deutsch. Zeit. Chir. Lücke, Bd. II., S. 380.....	6	1
Statist. des Hôp. de Paris,.....	1	0
Totals.....	96	18

Mortality, 19 per cent.

CONDITIONS IMPERFECTLY STATED; ABROAD.

AUTHORITIES.	CASES.	DIED.
Otis' collection of foreign military cases, Med. and Surg. Hist. War of Rebellion, part II., vol. II., p. 607.....	378	156
London Hosps.,.....	8	2
Trans. Ill. State Med. Society, 1863.....	6	1
Bericht k. k. allg. Krankenhaus, Wien.....	6	4
Archiv. klin. Chir. Bd. VIII., Bd. X., Bd. XI.....	28	9
Heyfelder Lehrbuch Resektionen, p. 210, being cases of Jägers, Paulo, Baudens, Esmarch, Ritter, Beith, Black- man and G. Meyer.....	169	30
Totals.....	595	202

Mortality, 34 per cent.

SUMMARY.

	CASES.	DIED.	PER CENT. MORTALITY
Total resections of shoulder abroad.....	1979	634	32
“ “ “ in Lake States.....	5	0	0

OPINIONS OF AUTHORS.

Gant's Surgery, p. 656, advocates resection of the shoulder in destructive diseases of the articulation.

T. Holmes, Syst. of Surgery, Vol. V., p. 664, says this operation is to be preferred to amputation in gunshot fracture and compound dislocation of the joint, when the injury is not too extensive, and is the only operation admissable in chronic disease of the joint, except perhaps rapidly growing tumor of the head of the bone, when he prefers amputation.

Billroth in his Surgical Pathology, p. 472, says it is safer than amputation.

Dr. Hodges, of Boston, in his excellent monograph says the results are excellent, but that the limb resulting being no better than that after natural ankylosis, the operation is not to be performed when there is good chance of natural recovery.

T. Holmes, of England, repeats the same opinion.

Bryant, of London, and Woodward, of Washington, (Cir. No. 6, S. G. O.) praise the operation, but Bryant's quotations of Cir. No. 6 are very inaccurate as to this point.

Ashurst says it ought not to be done for malignant disease.

The other authors for the most part accept it as an established and valuable operation, without special discussion.

Löffler (General-Bericht, 1867, S. 288,) favors it in military cases, but condemns it in the intermediary period.

Stromeyer, Schwartz, McLeod and Demme all favor the operation in military surgery.

CONCLUSIONS.

The five shoulder resections in the Lake States were all successful. In other regions the operation is fully recognized as far safer than amputation at the same point. The foregoing table of the operation abroad give as follows:

Average mortality of resection of shoulder joint, 32 per cent.			
"	"	amputation at	" " 39 "

Every motive, both of safety and of usefulness of the member requires resection to be preferred to amputation, whenever the conditions admit of the choice. Destruction of the head of the humerus and of considerable portions of the soft parts do not necessitate the loss of the limb. The decision rests mainly on the condition of the axillary nerves and vessels. Generally if, after an injury, there is a pulse at the wrist and some innervation in the hand, the resection is to be preferred.

In old irreducible dislocations with the head of the bone pressing on the axillary plexus, resection has been practiced, but in the present state of surgery a subcutaneous division of the ligaments to any extent necessary to allow of reduction, would usually be preferred.

The diseased conditions requiring the operation are for the most part so plain as to require no discussion.

The primary-stage has the least mortality, the secondary the next, and the intermediary period is decidedly the worst, and should be avoided whenever it is possible.

The classified results foot up as follows:

Mortality of primary cases.....	30	per cent.
“ of intermediary cases.....	46	“
“ of interm. and second. cases comb..	37	“
“ of pure secondary cases.....	29	“
“ of pathological cases.....	19	“

RESECTION OF THE ELBOW JOINT.

Of this operation my Lake State tables furnish me only two cases, both of which were successful. Abroad the figures were as follows:

PRIMARY RESECTION OF THE ELBOW ABROAD.

AUTHORITIES.	CASES.	DIED.
Med. and Surg. Hist. War of Rebel'n, pt. II., vol. II., p. 845	318	68
Rept. Boston City Hosp., Dr. Cheever.....	2	2
Warren, Confed. Amer. Army.....	1	1
Esmareh, quoted in Gant's Surgery, p. 675.....	11	1
St. George's Hospital, London.....	1	1
Chisholm's Mil. Surg., Amer. Confed. Army.....	25	3
Arch. klin. Chir., Billroth's collection, Bd. X., S. 892.....	4	2
“ “ “ Bd. XIII., S. 576.....	1	0
Deutsch Zeit. Chir., German-French War, Bd. I., S. 187, und Bd. II., S. 105.....	12	3
Siege of Strassburg, 1870-71. Dr. Herrgolt.....	4	1
Totals.....	379	82

Mortality, 22 per cent.

INTERMEDIARY RESECTIONS OF THE ELBOW ABROAD.

AUTHORITIES.	CASES.	DIED.
Med. and Surg. Hist. War of Rebellion, pt. II., vol. II., p. 845	196	69

Mortality, 35 per cent.

INTERMEDIARY AND SECONDARY RESECTIONS OF THE ELBOW
ABROAD, COMBINED.

AUTHORITIES.	CASES.	DIED.
Med. and Surg. His. War of Rebellion, pt. II., vol. 11., p.845	250	74
Warren's Surgery, Amer. Confed. Army, p. 399.....	3	2
Esmarch, quoted in Gant's Surgery, p. 675.....	29	5
Prof. Billroth, Arch. klin. Chir., Bd. X., S. 892.....	3	2
Billroth's Briefe.....	1	1
Chisholm's Mil. Surg., Amer. Confed. Army.....	36	6
Deutsch Zeit. Chir., Bd. I., S. 187 and Bd. II., S. 105.....	64	16
Dr. Koch, Arch. klin. Chir. Bd. XIII., S. 575-6.....	4	1
Dr. Herrgolt, Seige of Strassburg, 1870-71.....	7	5
Total.....	397	112

Mortality, 28 per cent.

PURELY SECONDARY RESECTIONS OF THE ELBOW ABROAD, (LATER
THAN INTERMEDIARY.)

AUTHORITIES.	CASES.	DIED.
Medical and Surgical History of the War of the Rebellion, part II., vol. II., p. 845.....	54	5

Mortality, 9 per cent.

PATHOLOGICAL RESECTIONS OF THE ELBOW ABROAD.

AUTHORITIES.	CASES.	DIED.
Boston City Hosp. Rep. Dr. Cheever.....	3	0
Dr. R. Hodges.....	119	15
Rostock Hospt. Rept., 1868.....	1	0
British Army Med. Repts.....	5	1
Gant's collection from British Hospitals.....	218	22
Heyfelder Lehrbuch der Rescctionen, S. 246.....	188	23
Statist. des Hôp. de Paris.....	5	2
Archiv. klin. Chir. Bd. VIII. and X.....	16	1
Totals.....	555	64

Mortality, 12 per cent.

RESECTIONS OF THE ELBOW, WITH CONDITIONS IMPER-
FECTLY STATED.

The following cases have been collected by various authors, whose sources of information are partly the same, so that a portion of the cases are duplicated, but as it is impossible to

get access to all the original documents quoted, the duplications cannot be eliminated. The totals, therefore, are too large, but as the duplications affect the cases and the deaths to the same extent, they do not materially vitiate the ratio of mortality:

AUTHORITIES.	CASES.	DIED.
Deutsch. Zeit. für Chir. Bd. II., III. and IV.....	140	25
Archiv. klin. Chir. Bd. III., IV., VIII., IX., XIII., XV. and XIX.....	428	56
Jahresbericht gesamt. Med. 1871, S. 403.....	1217	223
Dr. Billroth, Archiv. klin. Chir., Bd. X.	30	4
Zurich Hosp., 1860-67.....	25	3
Dutrelle's table.....	333	40
Heyfelder's Lehrbuch der Resectionen, S. 246-7.....	286	32
Bericht k. k. allg. Krankenhaus Wien.....	23	11
Stromeyer at battles of Langensalza and Kirchheingen.....	25	4
Statist. des Hôp. de Paris.....	2	1
Gant's collection from British Hosps., Surgery, p. 675.....	19	1
London <i>Lancet</i> , 1862.....	149	33
Circular No. 6, Surg. Gen. U. S. A.....	286	16
U. S. Marine Hospt. Reports.....	2	0
Trans. Ill. State Medical Society, 1863.....	4	1
Totals.....	2969	450

Mortality, 15 per cent.

GENERAL SUMMARY OF ELBOW JOINT RESECTIONS ABROAD.

Primary	22	per cent. mort.
Intermediary	35	" "
Intermediary and secondary combined.....	28	" "
Pure secondary (later than intermediary)... ..	9	" "
Pathological	12	" "
Unclassified	15	" "

OPINIONS OF AUTHORS.

As usual there has been some conflict among writers over this operation, but in the main they are pretty well agreed in its favor.

Circular No. 6, S. G. O., says that the mortality of it in the United States army was a little greater than that of amputation of the arm, but attributes it to the fact that many of the cases were partial resections which the author, Dr. Woodward,

considers more dangerous] than complete ones in traumatic cases.

The Medical and Surgical History of the War of the Rebellion (prepared by Dr. Otis,) shows that in the American war the secondary cases were far safer than the primary, but recommends the primary because many cases not operated on are supposed to die before reaching the secondary stage.—Part II., Vol. II., p. 905. Yet on page 829 it gives the total mortality of non-operative cases at only ten per cent., which is less than half that of primary excision. As the non-operative cases are generally military, we cannot infer that operation is to be rejected in bad cases, yet the success of the non-operative treatment suggests a doubt whether many would die while waiting for the advantages of the secondary period. The writer of the work thinks that in our army the substitution of resection of the elbow for amputation above effected no saving of life.

The French armies, according to Chenu's statistics, had a fearful mortality in resections of the elbow, so that Prof. Sédillot declares it ought to be rejected from the service; but the German surgeons in the Schleswig-Holstein war had brilliant success with it.

Hugelshofer, *Deutsches Zeitschrift für Chirurgie*, Bd. III., S. 8, gives the same opinion, viz.: that partial resections are dangerous, and ought not to be performed. At page 6 of the same article he assumes it as certain that complete resection is safer than amputation above the elbow, and remarks, "be the functional results good or bad, as you will, the preservation of a certain number of human lives, which would have fallen a sacrifice to amputation of the arm, or to conservative treatment, must give the operation the first place in the treatment of wounds of the elbow joint."

Heyfelder, in his *Lehrbuch der Resectionen*, pp. 246-7, gives statistics showing that partial resections are rather more dangerous than complete ones. In an essay elsewhere published, he says the results are brilliant.

Stromeyer recommends it in gunshot wounds.

Demme and Saltzman give the mortality of conservative

treatment for gunshot wounds of the elbow as over sixty per cent., which is nearly three times the danger of resection for similar wounds.

Hanover (*Deutsches Zeit. Chir.*, Bd. III., S. 7,) opposes the operation bitterly, declaring that of sixteen army cases only one succeeded in getting ankylosis, and that when ankylosis was not obtained the limb was useless and burdensome, and the patient prone to desire it amputated.

On the other hand, Hugelshofer says that in most cases a sufficient stiffening of the false joint is obtained to give a useful limb.

Lücke, of Berne, admits that absolutely firm ankylosis is not usually obtained, but says that a loose arm is better than none.

Neudörfer gives the operation a high rank.

Billroth says that of sixteen movable joints in his observation, all were more or less useful.

Bickersteth, of Liverpool, says that of forty cases, thirty-eight survived, and all had very useful limbs,

Gant's Surgery, p. 650, recommends the operation.

Holmes' System of Surgery considers the operation probably more dangerous than amputation of the arm.

Erichsen favors it in proper cases.

Gross' System of Surgery, Vol. II., p. 1085, considers it an established operation.

Bryant, Hamilton and Ashurst all recommend the operation in proper cases.

CONCLUSIONS.

The opinion of several of the above authors that excision of the elbow is more dangerous than amputation of the arm, is wildly erroneous. The foregoing summaries show that the mortality of the excision varies between nine and thirty-five per cent., while that of amputation of the arm is from twenty to thirty-six per cent. It is evident, therefore, that the consideration of safety is decidedly on the side of excision, if the condition of adjacent parts admits of the choice. In regard to conservative, as compared with operative treatment, there

are no figures properly arranged for a decision because the non-operative cases are generally the mildest. The conservative figures are very contradictory. Demme and Saltzman put the conservative treatment in gunshot wounds at sixty per cent., while Billroth observed it in twenty-four cases to be eight per cent. The Medical and Surgical History of the War of the Rebellion, part II., Vol. II., p. 829, has by far the largest mass of conservative figures, viz.: Cases, 924; deaths, 96; mortality, 10 per cent. This seems at first glance a fine result, but when we consider that they were mostly slight wounds, we see that we have no true basis of comparison.

When the bones are pulverized by the passage of a bullet, it would be folly to talk of conservatism.

Slight compound fractures of the joint, and mild cases of caries do best without operation, under Lister's antiseptic injections and dressings, but bad comminution of the bone or extensive necrosis require excision. Amputation only comes in when the destruction of the circulation, or the presence of cancer, or other incurable conditions render the loss of the limb unavoidable.

EXCISIONS OF THE WRIST JOINT.

I have occasionally performed this operation, but have preserved no records of the cases, nor obtained any from other Lake State surgeons.

Abroad the statistics are very meager, and of doubtful value.

I have gleaned from various works three hundred and five cases, with fifty-seven deaths, which is a mortality of nineteen per cent. Many of the cases were only partial, leaving the complex articulations of the remaining bones to suppurate and breed pyæmia in very unfavorable circumstances. It appears to me that complete resections would be far safer. The utter poverty of the literature on this subject compels us to lay it aside as not yet properly investigated.

Probably a complete resection would be advisable whenever it offers a fair opportunity to save a hand, whose innervation and circulation is in fair condition.

RESECTIONS AT THE HIP JOINT.

Of these I have nineteen cases from the Lake States, with eight deaths, which is a mortality of forty-two per cent. They were all cases of caries of the joint. The literature of the profession furnishes us the following figures for other regions:

TRAUMATIC PRIMARY RESECTIONS OF THE HIP ABROAD.

AUTHORITY.	CASES.	DIED.
Circular No. 2, S. G. O., p. 137, collected by Otis	39	36

Mortality, 92 per cent.

TRAUMATIC INTERMEDIARY RESECTIONS OF THE HIP ABROAD.

AUTHORITY.	CASES.	DIED.
Circular No. 2, S. G. O., p. 137, collected by Otis.....	33	30

Mortality, 91 per cent.

PURELY SECONDARY RESECTIONS OF THE HIP ABROAD.

AUTHORITY.	CASES.	DIED.
Circular No. 6, S. G. O., p. 137.....	13	11

Mortality, 85 per cent.

COMBINED INTERMEDIARY AND SECONDARY RESECTIONS OF THE HIP ABROAD.

AUTHORITIES,	CASES.	DIED.
Warren, American Confed. Army	1	0
Chisholm, " " "	2	1
Billroth's Briefe	2	2
Deutsch. Zeit. f. Chir. Bd. I., S. 187.....	1	1
Archiv. Klin. Chir., B. 13, S. 575.....	1	1
Totals.....	7	5

Mortality, 71 per cent.

Extensive statistics have been gathered on the Pathological Resections of the Hip Joint, by Hodges, Ashurst, R. Good, Heyfelder, Sayre, Fock, Leisrink and H. Lyster. These have been carefully collated by Ashurst, in the Pennsylvania Hospital Report, 1869, and in his Surgery, 1871. Gant, in his Surgery, published the same year, gives a collection of late

cases from British hospitals, which appear to be mostly or entirely additional to those collated by Ashurst. The two collections taken together give a tolerable summary of what is known on the subject, and are here subjoined:

PATHOLOGICAL RESECTIONS OF THE HIP JOINT ABROAD.

AUTHORITIES.	CASES.	DIED.
Ashurst's Surgery, p. 605; terminated cases.....	327	163
Gant's " p. 638; " "	79	22
Totals.....	406	185

Mortality, 46 per cent.

The cases of Sayre and other American surgeons are included in Ashurst's collection, with many from Germany, France, etc. Gant's cases are all British, and show decidedly better results than Ashurst's figures, which are gathered from all nations. The French and German cases especially are very fatal.

GENERAL SUMMARY.

	LAKE STATES.			ABROAD.		
	CASE	DIED	PER CT. MORT	CASE	DIED	PER CT. MORT
Primary	---	---	---	39	36	92
Intermediary.....	---	---	---	33	30	91
Purely secondary.....	---	---	---	13	11	85
Combined intermediary and secondary.....	---	---	---	7	5	71
Pathological.....	19	8	42	406	185	46

It appears, therefore, that in the Lake States we have no recorded experience of traumatic cases, but in pathological ones our results are somewhat better than the average given in surgical literature, and immensely better than in France, where Leisrink gives a mortality of eighty-six per cent. The seventy-nine late cases from British hospitals, however, give only twenty-eight per cent., which is better than the Lake States by eighteen per cent.

OPINIONS OF AUTHORS.

Only a few years ago excisions of the hip joint for disease

were generally condemned, but of late this opinion has been reversed.

Ashurst, (Penn. Hosp. Rept., 1869,) thinks it a serious operation, only to be undertaken when there is no reasonable prospect of recovery without it. He concludes:

1. That the sex of the patient is immaterial.
2. That the age is important, the success before puberty being much greater than after.
3. That total excisions are as successful as partial.
4. That in fatal cases only one-fourth of the deaths are due to the operation.
5. That in gunshot wounds (p. 211, Ashurst's Surgery,) fracturing the joint, excision, though very fatal, is the safest course.

Gant's Surgery, p. 632, claims that destruction of the articular cartilages of the hip without ankylosis always justifies the excision, (Mr. Hancock advocates the same practice,) but that the operation should not be performed for mere ankylosis. Mr. Gant says that disease of the acetabulum does not prohibit the operation, but that the effect of spontaneous dislocation is rather to be reckoned as opposed to excision. For gunshot fractures of the joint he seems to favor the excision, as being excessively fatal, yet about the only hope left the patient.

Prof. Sayre, of New York, says (*Orthopedic Surgery*, page 284), that in hip disease, with vitiated constitution and bones diseased beyond the operator's reach, the patient is probably hopeless; but when the disease is chiefly local, the constitution not undermined, the bones not affected beyond the possibility of removal, and the circumstances of air, food, etc., favorable, the operation offers the best possible chances of recovery.

Holmes, of England, in direct contradiction to Sayre, thinks that the poor patients, located in bad air and under bad nursing, are the ones that ought to be operated on to relieve them, as quickly as possible, from the irritating diseased bone, while patients in good circumstances will have a better chance without operation.

Hamilton favors the operation in a suitable selection of

carious cases, but doubts its applicability to gunshot wounds.

Gross, Erichsen, Druitt, Bryant, Holmes and Johnstone favor it in a proper selection of cases of hip disease.

Dr. J. S. Sherman, late Professor of Orthopedic Surgery and Diseases of the Joints in Chicago Medical College, says that in determining the question of excision for hip disease, "the general condition of the patient should be considered as much as the condition of the joint itself. Cases in which the general condition is bad, and which do not yield readily to treatment, should be operated on early, independent of the amount of caries; but where the general condition is good, and endurance can be expected, the operation should be postponed. The majority of such cases recover excellently without operation. Hence, it is justifiable to give them a chance and not exsect early, but if exhaustion occurs exsection is necessary."

Surgeon Otis, of the U. S. Army (Circular No. 2, S. G. O. P. 123), after the most elaborate view ever made of the subject of gunshot wounds of the hip, says:

"Primary excisions of the head and upper extremity of the femur should be performed in all uncomplicated cases of gunshot fractures of the head or neck. Intermediate excisions are indicated if the diagnosis is not made out till late, and also in gunshot fracture of the trochanter with consecutive arthritis. Secondary excisions are demanded by caries or secondary involvement of the joint from fractures or wounds in the immediate vicinity."

"Expectant treatment is to be condemned in all cases in which direct injury to the articulation can be clearly established."

Hamilton, as we have already mentioned, doubts the soundness of Otis' conclusion.

CONCLUSIONS.

In caries of the hip joint, below the age of puberty, excision is not a very dangerous operation; and, although the mortality is from twenty-five to forty per cent., yet only one-twelfth of the deaths are due to the operation. Almost always the patient is relieved, and if he dies it is in spite of the

operation. Above the age of puberty the danger of the operation is much greater, and the majority of the patients die.

If this excision is contemplated, therefore, in a child approaching the age of puberty, it should be done as early as possible, and after that age should not be done at all if it can be avoided.

Formerly excision of the hip for caries was generally condemned, but some twenty years ago the old prohibitions were broken over, and numerous cases were operated on. As experience accumulated, however, it was found that though the operation rarely killed the patient, yet the wounds were very slow in healing, so that in many instances those that were not operated on recovered fully as early as those subjected to excision. This damped the ardor of the operators somewhat, and at the present time we seem to be forced to about the following conclusions:

1. Cases of morbus coxarius which do not suppurate, of course do not suggest any operation.

2. Suppurative cases, which do well under tonics, antiseptic injections, etc., should have a full and prolonged trial of expectant treatment, and only be operated on if their progress seems to be obstinately slow.

3. Cases below puberty, which gradually get worse, the fistulas refusing to heal, and the patient steadily losing ground, should be operated on reasonably early, without waiting for extreme exhaustion.

4. Cases above puberty may be operated on if no other hope exists, but not until the minor operation of opening the joint and using antiseptic injections and dressings has been thoroughly tried on Lister's plan.

5. Sex exerts little influence on the results.

6. Disease of the ilium, to a moderate extent, is no obstacle to excision.

7. When spontaneous luxation occurs it usually relieves the patient of a great irritation, and favors spontaneous recovery, but if otherwise it constitutes no objection to excision.

8. The great majority of cases of suppurating hip disease will recover without operation.

9. In uncomplicated gunshot fractures of the hip joint, the present state of science indicates that excision should be performed as soon as possible, yet nine-tenth of the patients are reported as dying; and if all the cases were known, which the chagrin of the surgeons caused them to suppress, the mortality would show still worse. It is greatly to be desired that more light should be had on this terrible subject. Surgeon Otis could scarcely find a single clear case of recovery from gunshot fracture of the hip without operation (Cir. No. 2, p. 121), yet the depth of the parts caused the diagnosis to be very doubtful in many cases; and we may well stagger at an operation whose deaths are an unknown quantity, ranging somewhere between ninety and one hundred per cent. of the whole.

Perhaps the antiseptic plan would give better results.

RESECTIONS OF THE KNEE JOINT. •

This operation has received little favor in the Lake States. I have records of only eight cases, of which three died. All the eight cases were pathological.

In other regions we have the following list. (The numbers being too few, and the records too imperfect, the traumatic cases cannot be classified into primary, intermediary and secondary. They are all for gunshot wounds and display a fearful mortality):

TRAUMATIC RESECTIONS OF THE KNEE JOINT, ABROAD.

AUTHORITIES.	CASES.	DIED.
Circular No. 6, American Cases.....	10	8
“ No. 6, Foreign “.....	12	11
Chisholm, Confederate Army, United States.....	4	3
Warren “ “.....	1	0
Billroth, Arch. klin. Chir. B. X. und Briefe.....	2	2
Billroth's Briefe, p. 267.....	20	17
Geissel, German-French War.....	3	3
Herrgolt, “ “.....	1	1
Totals.....	53	45

Mortality, 85 per cent.

PATHOLOGICAL RESECTIONS OF THE KNEE JOINT, ABROAD

AUTHORITIES.	CASES.	DIED.
Boston City Hospt. Rept.-----	6	1
Cases Collected by Dr. R. Hodges, Boston-----	208	60
“ “ “ M. L. Peniere, 1762 to 1869-----	431	131
“ “ “ Gant from British Hosps. Gants' Surgery p. 621-----	241	64
Sundry German Operators-----	15	9
Totals-----	901	265

Mortality, 29 per cent.

Some of these figures of different authors include, partly, the same cases as others, and their analysis does not enable me to separate them completely; but as the repetitions affect both columns alike, they do not materially change the ratio of mortality.

GENERAL SUMMARY OF RESECTIONS OF THE KNEE.

	CASES.	DIED.	PER CT. MORT.
Lake States, Pathological-----	8	3	37
Traumatic, Abroad-----	53	45	85
Pathological, “-----	901	265	29

It appears, therefore, that, contrary to our experience in amputations, pathological resections of the knee have been less successful here than abroad. However, the number of our cases is so small that this may be an accidental occurrence.

OPINIONS OF AUTHORS.

Hodges shows that excision of the knee has a higher mortality than amputation above it, and that out of 208 case 102 failed or died.

Bryant, of London, shows that of 431 cases of disease of the knee which were amputated, the mortality was only twenty-two per cent., while of 178 similar cases resected, thirty-nine per cent. died. After a careful reievw of the subject, he opposes the operation.

T. Holmes speaks discouragingly of the operation, but

allows that it may, perhaps, be done in chronic disease of the knee, in patients below the middle age.

Gant favors excision cautiously in caries, provided the disease does not occupy too much of the bones. He endeavors to show that the mortality of excision of the knee is no greater than that of amputation of the thigh, and consequently preferable, because it saves the limb with no greater risk than is incurred in amputation. In this argument he commits the singular error of comparing the mortality of the excision with that of amputation of all parts of the thigh, high and low, alike. Now, the choice lies only between excision and amputation at the lower third of the thigh, where the mortality of amputation is much less than that of excision.

Pirogoff disapproves the operation in war surgery.

Hamilton discourages the operation, especially in gunshot wounds.

McLeod and Longmore oppose it in military practice.

Ashurst opposes it in gunshot cases, but allows it in disease. He says it is not very successful below five years of age, and very fatal in persons past the prime of life; but the safest period is from five years to puberty. Recent cases of disease should generally not be operated on; but only those which have either actually proceeded to caries and suppuration, or else show the characters of gelatinous arthritis (white swelling of old writers), in the doughy, semi-elastic swelling. In a suitable selection of such cases he recommends excision, but in those who are too old, or too young, or who have visceral complications, or too extensive disease of the bone to leave a useful limb after its excision, or who cannot afford the long time of recovery which excision requires, amputation is to be preferred. (*Med. Record*, Vol. 2, p. 443.)

Erichsen allows it doubtfully in extensive disease or faulty ankylosis.

Sir Geo. Ballingall favored it in civil, but opposed it in military practice.

Guthrie favored it in military practice, provided all the circumstances were favorable.

Gross approves it for disease, if the latter is not too extensive.

Butcher, Swain, Ferguson and P. H. Watson approve it strongly, and Druitt says it is one of the greatest triumphs of modern surgery.

CONCLUSIONS.

The above opinions are contradictory enough to satisfy the genius of discord. In such a confusion of precepts of the masters, we must appeal to the facts, which give us the following results:

	PER CENT.
Mortality of Traumatic Amputations of the Lower Third of the Thigh, Abroad.....	45 to 60
Mortality of the Traumatic Excisions of the Knee Joint, Abroad..	85
Mortality of Pathological Amputation of Lower Third of Thigh, Abroad.....	20
Mortality of Pathological Excision of the Knee, Abroad.....	29

The figures of the Lake States, so far as they go, confirm the showing of a much greater mortality for the excision than for the amputation.

Eighty-five per cent. is a terrible death rate, and is sufficient to condemn the traumatic excision to final oblivion. The pathological excisions are only nine per cent. worse than the amputations, and this difference is not so great but it may be properly overruled in some cases where the importance of saving a natural limb is very great. The drawbacks, however, must be considered, and they are these:

1. Owing to the inflamed condition of the bones the time of healing is often ten or fifteen months.
2. There is always considerable doubt about such an ankylosis of the bones as will enable the patient to step on the limb.
3. A large per centage of cases fail so completely as to necessitate a subsequent amputation.
4. In children, if the operator removes the entire epiphysis of the femur, the growth of the limb in length is, in a great measure, arrested.

A candid consideration of all these facts renders it impossi-

ble for the conscientious surgeon to recommend excision of the knee joint in more than a very few unusual cases.

The eight pathological excisions of the knee in the Lake States are too small a number to yield any special conclusions, yet the three deaths in the eight cases are a dismal recommendation when compared with our twenty-two pathological amputations of the lower third of the thigh, without a single death.

RESECTIONS OF THE ANKLE JOINT.

Of these the Lake States furnish us nine cases with one death, which is eleven per cent.

Abroad the literature is scanty, so that the subdivision of traumatic cases is impossible. Taken together they are as follows:

TRAUMATIC RESECTIONS OF THE ANKLE, ABROAD.

AUTHORITIES.	CASES.	DIED.
Deutsch. Zeit. B. V., S. 26.....	1	0
“ “ B. I., S. 187.....	2	2
“ “ B. II., S. 106.....	5	3
Stromeyer, Battle of Langensalza.....	1	0
Heyfelder, Resectionen, p. 162.....	67	6
Circular No. 6, S. G. O.....	18	6
Jaeger's Tables.....	29	1
Sir Astley Cooper.....	9	0
Josse.....	6	0
Taylor.....	5	0
Gants' Collection.....	4	1
Totals.....	147	19

Mortality, 13 per cent.

PATHOLOGICAL RESECTIONS OF THE ANKLE, ABROAD.

AUTHORITIES.	CASES.	DIED.
Hancock's Collection of British Cases.....	34	2
Heyfelder's Collection, deducting British Cases, Resectionen, p. 162.....	25	3
Archiv. klin. Chir. B. 8 und 10.....	10	3
Deutsch Zeit. B. II., S. 380, Lücke.....	3	1
Totals.....	72	9

Mortality, 12 per cent.

OPINIONS OF AUTHORS.

Hueter thinks resection of the ankle is indicated in suppurative inflammation of the joint.

Langenbeck had a "run of bad luck" with it, all his eight cases performed for caries being failures; however, he recommends it for many cases of gunshot wounds. He and the German surgeons generally favor the sub-periosteal method.

Mayer opposes partial resections, but A. Rose and Frank Hamilton favor them when circumstances demand.

Ashurst, p. 612, brings statistics to show that excision of the external malleolus has the same mortality as that of the entire ankle, viz.: twenty per cent.

Pirogoff believes resection of the ankle to be safer than amputation in compound fractures, and that the risk of conservative treatment is intermediate between the two.

Kade disapproves the operation in most cases.

Gant, p. 644, favors the operation for disease, provided the affected portions of the bones do not extend too far from the joint. In gunshot wounds of the ankle, he generally prefers excision to amputation, p. 289.

Ashurst, pp. 211 and 612, favors both traumatic and pathological excisions.

Holmes, in the first edition of his *System of Surgery*, opposed the operation, but in the second edition retracts his opinion, and cautiously favors excision.

Gross advocates it where the caries is not too extensive.

Erichsen and Druitt both oppose it.

CONCLUSIONS.

As compared with amputation of the leg in the lower third, excision of the ankle is much the safest.

The following figures show the difference:

	Mort. of Exc. of Ankle, Abroad.	Mort. of Amp. of lower 3d of Leg, Abroad.
Traumatic.....	13 per cent.	33 per cent.
Pathological.....	12 "	16 "

In the Lake States the operation has proved a little safer than abroad, viz.:

Average Mortality of all Excisions of Ankle, Abroad.....	12½ per ct.
“ “ “ “ “ Lake States.....	11 “

As between excision and amputation there is only one conclusion possible. Excision is far the safest, and also preserves a useful foot for walking. It is therefore to be preferred to amputation whenever the choice is possible; that is, when the foot is not mortified, nor the parts above and below the joint too much diseased or disorganized to allow their serving a future useful purpose. It is here to be remembered that Lister's antiseptic treatment has revolutionized some of our precepts. I have, by this method, healed an ankle proved by the probe to be completely carious, though I am sure that one could not always succeed in that way. It would be well in many cases to give it a trial before proceeding to excision. In the same antiseptic way, many compound dislocations and fractures of the joint can be readily cured without operation.

On the whole the following statement probably gives pretty nearly the truth:

CASES FOR AMPUTATION.

1. Death of the foot from any cause.
2. Cancer or incurable disease of the foot, rendering its presence pernicious.
3. Caries and necrosis, so destroying the parts above and below the joint as to render it impossible to remove the disease and have the end of the tibia rest on the foot, or to preserve periosteum enough to reproduce the bones.
4. Compound fractures effecting similar destruction of parts.

CASES FOR EXCISION.

1. All ordinary cases of caries, which resist antiseptic treatment.
2. Certain cases of talipes, and displacement from old accidents, which resist orthopedic treatment.
3. Compound fractures and dislocations which have resisted antiseptic measures, and have not destroyed the circulation in the foot.

4. Dislocations of the astragalus, and compound dislocation of the tibia forward which will not remain in position after being reduced.

CASES FOR ANTISEPTIC TREATMENT.

1. Caries in its earlier suppurative period.
2. Simple suppuration of the joint.
3. Compound fractures and dislocations which will stay reduced, which have not destroyed the circulation in the foot, nor hopelessly disorganized too much of the adjacent parts.

OPERATIONS UPON THE LARYNX AND TRACHEA.

Of these I have obtained trustworthy records of thirty-five cases, some of which are of decided interest:

TABLE XIII.
OPERATIONS ON THE LARYNX AND TRACHEA.

No. An- drew's Sir. Rec	OPERATOR.	Age.	REASON FOR OPERATION.	COMPLICA- TIONS.	OPERATION.	Cond. at opr.	Time to operation.	Result.	Time to death or recovery	Practice.
---	Dr. H. A. Johnson	2	Membr. cramp	None	Trache. abv. thyroid gland.	Bad.	3 days	Died	1 hour	Private
---	" " "	6	Diphtheria	None	Laryngotomy	"	4 or 5 days	"	1 "	"
116	" E. Andrews	4	Membr. cramp	None	"	"	"	"	6 weeks	Hospital.
138	" H. A. Johnson	1	Diphtheria	None	"	"	"	"	24 hours	Private
674	" E. Andrews	1	"	None	"	"	"	"	"	"
7393	" " "	12	Oedema glottidis	None	Trache. below thyroid.	Good	1 or 2 days	Recovered	"	"
7392	" " "	2	Foreign body in trachea	None	"	Bad.	some hours	Died	1 hour	"
7394	" " "	5	"	None	" in haste	"	"	"	10 min.	"
7395	" H. A. Johnson	7	Diphtheria	None	above thyroid	Med.	"	"	4 days	"
7398	" E. Andrews	4	"	None	Laryngotomy	Bad.	"	"	3 "	"
7399	" " "	3	"	None	"	"	"	"	3 "	"
8003	" " "	4	Stricture of glottis with asphyxia.	Phtisis	Trache. above thyroid.	"	"	Successful	"	Hospital.
---	" Herriek	4	Oedema	None	"	"	"	Recovered	"	"
---	" D. Brannard	1	Abscess at root of tongue	None	"	"	"	"	"	"
---	" " "	2	Foreign body in trachea 3 months	None	"	"	"	"	"	"
---	" H. A. Johnson	3	Diphtheria	None	above thyroid.	Bad.	4 days	Died	24 hours	Private
---	" " "	3	Membr. cramp	None	"	"	"	"	5 "	"
---	" H. Wardner	1	"	None	"	"	"	Recovered	120 "	"
---	" " "	1	"	None	"	"	6 "	Died	12 "	"
---	" " "	3	"	None	"	"	7 "	"	10 "	"
---	" H. A. Johnson	2	"	None	above thyroid.	"	48 hours	"	"	"
---	" E. Powell	30	Oedema of larynx.	Oedema of larynx	"	"	"	"	"	"
---	" J. W. Fraer	---	Foreign body in larynx.	None	Laryngo-tracheotomy.	"	16 days	"	26 "	Hospital.
---	" J. Andrews	2	Foreign body in trachea	None	Trache. below thyroid.	"	2 weeks	Recovered	14 days	"
---	" Gunn	3	Diphtheria	None	"	Good	"	"	"	Private
---	" R. G. Boque	7	"	None	"	Bad.	10 days	"	28 days	"
---	" H. A. Johnson	7	Epithelioma in larynx	None	High trache. Tumor re- moved twice, 2d successf.	Med.	1 year.	"	"	"
---	" " "	3	Diphtheria	None	Trache. above thyroid.	Bad.	4 days	Died	1 hour	"
---	" " "	10	"	None	"	Bad.	8 "	Died	10 hours	"
---	" " "	60	Cancer in larynx	None	"	Med.	5 months	Lived	3 mos.	"
---	" " "	5	Diphtheria	Art. mortis	"	Bad.	7 days	Died	few hrs.	"
---	" " "	6	Membr. cramp	None	"	Fair	5 "	"	23 hours	"
---	" " "	4	"	None	"	"	7 "	"	22 "	"
---	" " "	40	Swelling of laryngeal muc. memb.	Ule. larynx	"	"	Not stated.	Lived	"	"

RECAPITULATION.

	CASES.	DIED.	PER CENT. MORTALITY.
Total for all causes.....	35	20	57
For memb. croup or diphtheria.....	21	17	81
For foreign bodies in trachea.....	6	2	33
For Oedema glottidis.....	4	1	25
For other causes.....	4	0	0

The diphtheritic portion of the cases, arranged by age, are as follows:

	CASES.	DIED.
Under 1 year.....	3	2
1 to 2 years.....	3	3
2 to 3 ".....	4	3
3 to 4 ".....	3	2
4 to 5 ".....	1	1
5 to 6 ".....	2	2
6 to 7 ".....	2	2
7 to 8 ".....	1	1
8 to 9 ".....	0	0
9 to 10 ".....	1	1

The case of epithelioma of the larynx was a remarkable one. The growth obstructed respiration, so that asphyxia was imminent. Prof. H. A. Johnson then performed tracheotomy. The tumor continued to grow until it encroached downward upon the lower part of the larynx; the patient still wearing the tracheotomy tube. Prof. Johnson then divided the thyroid cartilage in the middle line, and removed the growth, which had its seat just below the vocal chords. The wound healed nicely, the patient still wearing the tracheotomy tube. After a considerable period the growth returned, and Prof. Johnson repeated the thyrotomy, removed the tumor more thoroughly, and cauterized the seat of it with nitric acid. The recovery was good, and the surprising part is that after two operations of thyrotomy, the patient has a good and constantly improving use of the vocal chords in speaking. The last operation was many months ago. The tumor has not returned. Its character as an epithelioma was thoroughly demonstrated by the microscope.

LARYNGOTOMY AND TRACHEOTOMY, ABROAD; FOR DIPHTHERIA OR CROUP.

AUTHORITIES.	CASES.	DIED.
Boston City Hosp. Rept.	9	5
Prof. Wilms, of Berlin	335	232
Arch. klin. Chir. Dr. Kühn, B. 8	277	152
K. k. allg. Krankenhaus, Wien	10	7
St. Bartholomew's Hosp. Repts.	10	6
Totals	641	402

Mortality, 63 per cent.

LARYNGOTOMY AND TRACHEOTOMY FOR DIPHTHERIA OR CROUP,
ABROAD.

Arranged by Ages, from Prof. Wilms, of Berlin.

	CASES.	DIED.	PER CENT. MORTALITY.
Under 2 years	6	6	100
From 2 to 3 years	56	41	73
From 3 to 4 years	69	47	68
From 4 to 5 years	74	56	76
From 5 to 6 years	57	37	65
From 6 to 7 years	33	18	55
From 7 to 8 years	21	16	76
From 8 to 14 years	19	11	58

LARYNGOTOMY AND TRACHEOTOMY ABROAD, FOR OEDEMA GLOTTIDIS.

AUTHORITIES.	CASES.	DIED.
Archiv. klin. Chir., B. 8, S. 559	73	19

Mortality, 26 per cent.

LARYNGOTOMY AND TRACHEOTOMY, ABROAD; FOR REMOVAL OF
FOREIGN BODIES.

AUTHORITIES.	CASES.	DIED.
Archiv. klin. Chir., B. 8, S. 559	149	40
Dr. Durham, Holmes' Syst. Surg., Vol. II., p. 496	167	37
Prof. Hamilton, of Columbus Med. Col., O.	46	12
Totals	362	89

Mortality 25 per cent.

LARYNGOTOMY AND TRACHEOTOMY FOR ALL CAUSES, ABROAD.

AUTHORITIES.	CASES.	DIED.
Boston City Hosp.-----	15	6
A. E. Durham's collection of cases operated on for foreign bodies, Holmes' Syst. Surg.-----	167	37
Med. and Surg. Hist. War of Rebel'n, Vol. I., Pt. I.-----	20	13
K. k. allg. Krankenhaus, Wien-----	46	22
Statist. des Hôpit. de Paris, 1861-3-----	513	354
Hôpit. des Enfants Malades, Paris, 1851-63, quoted by Fischer & Bricheteau, Traitement du Croup, etc.-----	1013	749
Hôpit. St. Eugénie, Paris, 1854-61, same authority-----	396	329
Same Hosp't., 1862-3. Statist. des Hôpit., Paris-----	235	153
Other Hosp. of Paris. " "-----	17	11
Dr. J. Kühn, Arch. klin. Chir., B. 8, S. 559-----	707	269
Totals-----	3119	1943

Mortality, 62 per cent.

OPINIONS OF AUTHORS.

Dr. H. A. Johnson, Prof. of Diseases of the Respiratory and Circulatory Organs in the Chicago Medical College, has had more experience in tracheotomy, probably, than any one in the Lake States. He gives the following opinion:

“Tracheotomy or laryngotomy should be performed in all cases of threatened asphyxia from causes which cannot be speedily removed by other methods, as for instance in cases of

“1. Foreign bodies in the larynx not easily reached and removed through the natural passages.

“2. Œdema of the glottis, threatening death from asphyxia.

“3. Tumors, malignant or non-malignant, in the larynx, threatening asphyxia, and not easily removed through the natural passages.

“4. Acute inflammation, simple or diphtheritic, producing so much obstruction to respiration as to materially diminish oxygenation of the blood.

“The danger in all these cases is not so much from the operation as from the disease for which it is performed, hence the earlier it is done the better.

“The operation is seldom successful in children under two years of age.

"In young subjects especially high tracheotomy is preferable to the low operation.

"Ether may be given when there is not much asphyxia, but in the asphyxiated condition there is already anæsthesia. The exhibition of ether in such condition probably adds to the danger."

A. E. Durham, of Great Britain, (Holmes' System of Surgery,) says laryngotomy should not be performed in early childhood, on account of the small size of the crico-thyroid membrane; nor in acute or extensive disease or injury of the larynx, but is adapted for adults, and especially for males. It is the best operation for foreign bodies impacted in the larynx, and for polypus, stricture and limited chronic disease of the organ. He recommends laryngo-tracheotomy when the patient is too young for laryngotomy, and the surgeon fears to go below, but not for adults, lest the voice be injured.

Tracheotomy he advises for adults, and generally the lower operation in dyspnœa from acute laryngitis, polypi, syphilitic diseases, etc.

A. W. Barclay, of Great Britain, (Holmes' System of Surgery, Vol. IV., p. 513,) says in respect to membranous croup, "Our chief resource for prompt relief to breathing is tracheotomy." He distinguishes membranous croup from diphtheria, and is dubious about the operation in the latter disease, but concludes that it is justifiable where the dyspnœa is so urgent as to throw other symptoms into the shade.

Erichsen says that tracheotomy and laryngotomy are required in croup and diphtheria when the laryngeal obstruction to respiration is great, and pulmonary and bronchical disease relatively slight. Many cases of dyspnœa from other diseases and from accidents also require it.

Gross advises tracheotomy in urgent dyspnœa in œdema glottidis, diphtheria, etc., and also for foreign bodies in the air passages.

Hamilton prefers crico-thyroid laryngotomy in apnœa from hanging, drowning, and other causes requiring haste, thyrotomy for laryngeal growths, and high tracheotomy for most cases of diphtheria and croup requiring operative relief. Low

tracheotomy he admits only for cases complicated with bronchocele, or for impaction of foreign bodies in the bronchi.

Druitt advises tracheotomy or laryngotomy for threatened asphyxia from croup, diphtheria, or from any other disease.

CONCLUSIONS.

The opinions of Prof. H. A. Johnson, quoted above, express the results of the best investigations on this subject so correctly that it seems unnecessary to do more than refer to them as in my opinion giving the proper indications for this operation.

As between the Lake States and other regions the figures show to our disadvantage, thus:

Mort. of laryngotomy and tracheotomy, 54 per cent.

Ditto in Lake States, 81 " "

I think this inferiority in the results of our surgery is due to two causes:

1. Operating on too many patients below the age of two years.

2. Delaying the operation until the patient was too far exhausted to recover.

The operation ought to be performed earlier.

LITHOTOMY.

Calculous diseases of the urinary organs in the Lake States seem to be less frequent than in Missouri, Kentucky and Tennessee. This is probably due to the fact that the water of the Great Lakes, which furnish the drink of all the towns on its shores is almost destitute of any mineral constituents, and differs but little from rain-water. Hence there is probably no surgeon on these shores who can show a list of cases so numerous as some of the operators elsewhere have done.

TABLE XIV.

LITHOTOMY.

NO. IN MY REC'D	OPERATOR.	AGE	SEX	DESCRIPTION OF CALCULUS.	COMPLICATIONS.	OPERATION.	Cond. at op.	Time to Operation.	Result.	Time to death or recovery.	Practice.
154	Dr. Z. Pitcher	F	12	Large calculus.		Supra-pubic.					
90	Dr. E. Andrews.	M	7	Calculus fusible, 1 x 1½ in.	Dribbling of urine.	Lateral	Good	some years	recovered	4 weeks.	Private
971	"	M	38	" " 1 x 1¼ "	Chronic cystitis	"	"	"	recovered	30 days.	Private
1234	"	M	11	" " 2½ x ¾ "	None	"	"	"	"	6 weeks.	"
1720	"	M	15	" " 1 x 1½ "	"	"	"	"	"	"	"
1745	"	F	55	" " 1 x 1¼ "	"	Forward to pubis & left	"	"	"	"	"
	"	M	65	" " ¾ "	Severe hemorrhage	"	"	"	"	"	"
	"	M	35	" " ¾ "	fr. bladder bc. op.	Lateral	Bad.	4 years.	died	2 days.	"
1766	"	M	6	" " ¾ "	None	"	Med	some years	recovered	"	"
1783	"	M	35	" " 1¼ x 1¼ "	"	"	Good	1½ years	"	"	"
1785	"	M	5	" " 1¼ x 1¼ "	"	"	"	1½ years	"	25 days.	"
1789	"	M	7	" " 1½ x 2 "	"	"	"	"	"	"	"
5700	"	M	12	" " 1 x 2 "	Incontinence of ur.	"	Bad.	several yrs.	"	"	"
5176	"	M	2	" " ¾ "	None	"	Med	4 years.	died	11 weeks.	Hospital
6060	"	M	3	" " 1½ "	"	"	Good	since birth.	recovered	"	Private
6151	"	M	35	" " ¾ "	"	"	"	some years	"	"	"
6550	"	M	32	2 Calculi	"	"	Med	"	"	3 weeks.	Hospital
6835	"	M	1	Calculus mulberry, 3¼ dr.	"	"	"	"	"	3 "	"
6930	"	M	40	" " fusible, 1x1¼ in.	"	"	"	"	"	4 "	"
7017	"	M	42	" " small	"	"	"	"	"	4 "	"
7525	"	M	2	" " 1¼ in. long.	"	"	Good	"	"	1 mos.	Private
7799	"	M	5	Phosphatic calculus, 1x1¼.	"	"	"	1 year	"	3 weeks.	"
7693	"	M	39	" " comb. 3½ oz	"	"	"	Unknown	"	6 "	Hospital
8407	"	M	11	Calculus in memb. portion	"	"	"	"	"	"	"
8515	"			of urethra, 2½ in. long.	"	"	"	"	"	"	"

RECAPITULATION.

	CASES.	DIED.	PER CENT. MORTALITY.
Total Lithotomy.....	48	11	23
Lithot. over age of puberty.....	21	8	38
“ under “.....	26	3	12
Hospital.....	21	8	38
Private practice.....	28	3	11
Lithotriety.....	1	0	0

LITHOTOMY ABROAD.

AUTHORITIES.	CASES.	DIED.
Gross' cases—Gross on Ur. Org., p. 276.....	140	12
Mott's “ “ “ “ p. 276.....	162	7
Mettauer's “ “ “ “ p. 276.....	91	4
Kissam's “ “ “ “ p. 276.....	65	3
Goldsmith's “ “ “ “ p. 276.....	58	3
N. R. Smith's “ “ “ “ p. 276.....	45	3
Dudley's cases, Ky., given by Eve, Trans. Am. Med. As. 1871	225	7
Eve's cases, Tenn., adults.....	51	8
“ “ “ “ children.....	45	3
Pope's cases, St. Louis, Mo., adults.....	35	2
“ “ “ “ children.....	32	2
Boston City Hospital Report.....	5	0
Pennsylvania Hospital.....	111	18
United States Marine Hospital Report.....	1	0
Circular No. 3, S. G. O.....	9	1
Sir Henry Thompson's British Collection minus, the Nor- wich cases.....	1034	123
Mr. Chas. William's table of Norfolk and Norwich cases for 97 years.....	1015	132
St. Bartholomew's Hospital.....	73	13
St. George's “.....	17	1
British Army Reports.....	6	0
Luneville's Hosp.—Gross on Ur. Org., p. 276.....	365	33
Hotel Dieu, La Charité and Hôp. des Enfants—Gross on Ur. Org., p. 276.....	133	33
St. Mary's Hosp., Moscow—Gross on Ur. Org., p. 276.....	411	42
Loretto Hosp., Naples— “ “ “ p. 276.....	533	82
Saharanpore Disp., India— “ “ “ p. 276.....	824	108
K. k. allg. krank. Wien.....	65	25
Mission Hosp., Canton, China, Dr. Kerr.....	187	19
Totals.....	5758	674

Mortality, 12per cent.

The effect of age is shown by the following figures of Sir Henry Thompson:

MORTALITY OF LITHOTOMY AT DIFFERENT AGES.

DURING THE YEARS.	CASES.	DIED.	PER CENT. MORTALITY.
1 to 5, inclusive.....	473	33	7
6 to 11, ".....	377	16	4
12 to 16, ".....	178	19	11
17 to 20, ".....	76	11	14
21 to 29, ".....	86	11	13
30 to 38, ".....	75	7	9
39 to 48, ".....	100	17	17
49 to 58, ".....	191	40	21
59 to 70, ".....	233	63	27
71 to 81, ".....	38	12	32

The following figures are taken from Mr. Keith's table, British Medical Journal, March 20, 1869, and show the mortality in groups of twenty years:

AGE.	CASES.	DIED.	PER CENT. MORTALITY.
Under 21 years.....	1530	151	10
21 to 40 years.....	356	66	19
41 to 60 ".....	477	108	23
Over 60 ".....	479	156	33

Dr. Dulles, of Philadelphia, in the Am. Jour. Med. Sci., July, 1875, gives a table showing how the dangers of lithotomy increase with the weight of the stone, as follows:

Under one ounce.....	Mortality, 9 per cent.
One to two ".....	" 16 " "
Two to three ".....	" 41 " "
Three to four ".....	" 43 " "

Mr. Crosse and Dr. Gardner calculate the mortality according to size as follows for the Norfolk and Norwich Hospital and the Saharupnore Dispensary:

	CASES.	DIED.
One ounce and under.....	969	88
One to two ounces.....	249	38
Two to three ounces.....	68	25
Three to four ounces.....	21	12
Four to five ounces.....	11	6
Five to six ounces.....	7	2
Six to seven ounces.....	2	2
Totals.....	1327	173

MEDIAN OPERATION.

Prof. Gross (Urin. Org., 1876,) gives the following collections:

	CASES.	DIED.
American Surgeons.....	205	9
Reyer, of Cairo.....	56	9
Norfolk and Norwalk Hosp.	64	13
Pemberton, of Birmingham.....	25	1
Totals.....	350	32

Mortality, 9 per cent.

BILATERAL OPERATION.

Cases, 536. Died, 41. Mortality, 8 per cent.

RECTO-VESICAL OPERATION.

Cases, 83. Died, 16. Mortality, 19 per cent.

SUPRAPUBIC OPERATION.

Dr. Dulles, of Philadelphia, gives the following comparison between the lateral and suprapubic operation, which seems to indicate that the latter is safest for stones of very large size, but not for those of less than two ounces weight:

WEIGHT OF STONE.	LATERAL OPER.		SUPRAPUBIC OPER.	
	CASES.	DIED.	CASES.	DIED.
Under one ounce.....	529	47	14	3
One to two ounces.....	119	18	21	4
Two to three ounces.....	35	16	14	4
Three to four ounces.....	11	7	19	6
Four to five ounces.....	5	3	16	7
Five to six ounces.....	2	0	11	4
Six to seven ounces.....	2	2	2	1

LITHOTRITY.

This operation has been inexcusably neglected in the Lake States. I have record of only one case, which was however successful.

LITHOTRITY ABROAD.

AUTHORITIES.	CASES.	DIED.
Brodie	115	9
Fergusson.....	109	12
Keith of Aberdeen.....	116	7
Thompson.....	204	13
Crichton	122	8
Boston City Hospital.....	1	0
Pennsylvania ".....	14	2
Trans. Am. Med. As., 1871, Prof. Eve.....	4	0
Trans. N. Y. Med. Soc.....	49	9
Statist. Hôp. de Paris, 1861-2-3	56	9
Civiale, Paris.....	591	14
K. k. allg. Krank, Wien	42	16
Lücke, Berne.....	2	0
Dr. J. G. Kerr, Mission Hosp., Canton, China.....	30	3
Totals.....	1455	102

Mortality, 7 per cent.

The large figures of Civiale, in the above list, showing a mortality only one-third that of the best surgeons elsewhere, have been received with much incredulity, and even gave rise to direct charges of falsehood; especially as the official statistics of the hospitals of his own city show a mortality six times as great.

It would be, perhaps, safer to exclude the Parisian statistics from the list entirely, which would leave the results of the operation elsewhere, as follows: Cases, 808; deaths, 79; mortality, 10 per cent. Probably this is not far from the truth.

OPINIONS OF AUTHORS.

Civiale was almost the inventor of lithotritry, or, at least, he was the first to give it a practical form, and to establish it in the profession. He advocated it warmly as a matter of course.

Sir Henry Thompson says that lithotomy should not be performed in adults, for stones, unless they are above the middle size, say larger than an almond; but lithotritry be substituted for it. Above the middle size he would be guided by the condition of the patient, as to his probable ability to

bear the number of sittings requisite to pulverize such large calculi.

Most authors prefer lithotomy for children, both because the risk is slight and because the urethra is inconveniently small for lithotritry, and the child will not readily remain quiet during the sittings of the latter operation; yet Ferguson and others have performed it on children, and Coulsen claims that it will prove safer for them than lithotomy.

Mr. Hawkins (Holmes, Syst. Surg., Vol. IV, p. 1112) opposes lithotritry in children, but that in adults irritable bladders and diseased kidneys do not, as was formerly thought, necessarily forbid it.

Erichsen, Bryant, Morland, Gross, Ashurst and Hamilton agree for the most part as follows.

Lithotomy is generally to be preferred:

1. In children.
2. In very narrow and irritable urethras, with the calculus large.
3. In cases with badly diseased, irritable, sacculated or very atonic bladders.
4. In very hard stones over an inch in diameter, or softer ones over an inch and a half in diameter.

Lithotritry is preferred by these authors in nearly all other cases, but the rules must be subject to exceptions in cases where special combinations of circumstances require it.

CONCLUSIONS.

Lithotomy is a rather rare operation in the Lake States. Its success here is also less than abroad, a fact in striking contrast with most other operations.

Of our forty-eight cases on record eleven died, which is twenty-three per cent., while the rest of the world gives us in over five thousand cases a death rate of only twelve per cent.

If we compare the Lake States with Missouri, Kentucky and Tennessee the contrast is still greater. In the latter States three hundred and eighty-eight cases give only twenty-two deaths, which is less than six per cent. The only reason

which I can offer for our inferior results is, that the disease being rare in the Lake States, the people, though so alert in business affairs, are unaccustomed to think of this disease, and in its earlier stages rarely suspect its existence. On this account they generally neglect it until it is so far advanced that the safest period for operation has passed by.

One of my worst cases was that of a highly educated man who had a calculus for many years, and yet obstinately refused to entertain the idea of its existence, and rejected all the advice of his physician to submit to an examination.

The remarkable results of lithotomy in Missouri, Kentucky and Tennessee are due to several causes:

1. The frequency of the disease keeps the populace alert on the subject, and prompt to seek aid if it is suspected.

2. Owing to the mildness of the climate the houses are extremely open to ventilation, even in many cases to the actual absence of doors and to the leaving out of all "chinking" from the interstices of the numerous log cabins. Houses are built, not for tightness and warmth as in our cold climate, but for coolness and ventilation. The patients, therefore, are exempt, from many causes of pyæmia and other septic complications.

3. The population is thoroughly well fed and magnificently developed, averaging considerable taller and larger than in most other States. They are, therefore, better subjects for operation than the denizens of northern States, who are largely immigrants from Europe.

4. Dr. Dudley, of Kentucky, selected his cases. Prof. Eve says that in addition to his two hundred and twenty-five operations there were about eighteen patients, or seven per cent. of all whom Dudley rejected on account of their bad condition. If any surgeon rejects seven per cent. of his most unpromising cases it will make a great difference in the per cent. of mortality, yet few conscientious men will feel justified in refusing to give a man a chance for his life simply because that chance is not as good as the average.

Dr. Dudley, I believe, generally used a gorget, and the bilateral incision. If I am correct in this, his large number

of selected cases is probably the reason why our figures show only eight per cent. of mortality for the bilateral method. The old rule is probably true which reserves the bilateral incision for the larger stones.

The results of the median operation seem to show very favorably, giving a mortality of only nine per cent., but it must be remembered that these are selected cases, only small stones being operated on by that method, and hence the figures give no true basis of comparison. Mr. A. Poland, in Holmes' System of Surgery, compares sixty-four cases of median with sixty-four cases of lateral lithotomy, and finds that the lateral proved the safest. On the whole it seems doubtful whether the median method possesses any decided advantage, and in future we shall hear less of it except in children, because it is now conceded that the majority of adult cases adapted to that plan are better treated by lithotrity.

Suprapubic lithotomy seems, if the small number of tabulated cases can be trusted, to be the safest plan in stones weighing over two ounces.

LITHOTRITY.

This operation has been greatly and improperly neglected among us. We have not cases enough to determine its risk. Abroad the average mortality has been seven per cent., or if we exclude the enormous and disputed list of Civiale, it will be ten per cent.

The later operations seem more successful than the earlier. Perhaps seven per cent. may approximately represent the present average.

There is no doubt that in almost all adult cases lithotrity is the safest operation, and that it should be preferred whenever special conditions of the patient do not render it ineligible. The present drift of science favors extending the application of the operation as much as possible.

OPERATIONS FOR MECHANICAL OBSTRUCTIONS OF THE INTESTINES.

Of these I find record of fifty cases, which are here subjoined:

TABLE XV.—Continued.

Dr. E. Andrews.	Cancerous stricture of rectum	None	Lumbar colotomy	Med.	years	Recov'r'd	Hospital
92	Stricture of rectum.	None	Forced dilatation	Bad.	2 years	Improved	Private
133	Stricture of rectum.	None	Gradual	Good	2 years	"	"
6232	Cancerous stricture of rectum	None	Forced	"	2 years	"	Hospital.
6596	Stricture of rectum.	None	Cut the stricture	"	"	Cured	Improved
7227	Stricture of rectum.	Lupus of anus.	Forced dilatation.	Bad.	"	Died	Private
7602	"	"	"	Good	"	Improved	Hospital.
"	"	None	"	"	"	"	Private
7781	Intussusception	"	Gradual	Med.	3 days	Died	"
"	"	"	Pneumatic aspiration	Good	1 day	"	Hospital
"	"	"	Forced injections.	Good	8 hours	Cured	Private
"	"	"	"	Bad.	24 hours	"	"
"	"	Gut mortified.	"	Med.	1 day	Died	"
"	"	None	"	"	"	"	"

RECAPITULATION.

	CASES.	DIED.	PER CENT. MORTALITY
Herniotomy	34	8	24
Pneumatic aspiration of strangulated hernia	1	0	0
Forced injections for intussusception	5	3	60
Pneumatic aspiration for intussusception	1	1	100
Forced dilatation of stricture of rectum	6	1	17
Gradual dilatation of stricture of rectum	2	0	0
Incision of stricture of rectum	1	0	0

HERNIOTOMY ABROAD.

The literature of the profession furnish the following statistics:

AUTHORITIES.	CASES.	DIED.
Bellevue and Charity Hosp., New York, Hamilton	31	15
Boston City Hosp.	10	7
Boston Private Practice of Dr. Cheever	17	7
United States Marine Hosp. Repts.	5	1
London Hosps.: quoted Arch. klin. Chir., Bd. 8, S. 30.	326	136
Large British Prov. Hosps. " " " " " " " "	177	72
Small " " " " " " " "	118	53
Dutrepont's personal observations	12	1
Paris Hosps., Old statistics of Malgaigne	220	133
" " Statist. des Hôp. de Paris, 1861-2-3	172	136
Textor's Cases, Wurtzburg	56	24
K. k. allg. Krankenhaus, Wien	259	114
Deutsch, Zeitschrift, Bd. 2, S. 381	27	16
Arch. klin. Chir., Bd. 11, S. 320, 341	45	15
Totals	1475	730

Mortality abroad, 49 per cent. Mortality in the Lake States, 24 per cent.

It thus appears that the danger of this operation in the Lake States is less than half that of the published statistics abroad. I can only account for this by the fact that the alert, wide awake western man when he has a strangulated hernia which he cannot reduce himself, comprehends the urgency of his case, and promptly sends for professional help. The operations are therefore performed early, and are consequently successful.

The slowness of the same people to apply for help in cases of calculus is because the latter disease being rare here, and coming on insiduously, is not understood nor suspected until a late period of its progress.

OPINIONS OF AUTHORS.

There is no controversy, of course, as to the frequent necessity of this operation, and still further, all surgeons are agreed that when necessary it should be performed at the earliest practicable moment, as every hour increases its danger.

Almost the only point of controversy has been whether the peritoneal sac should be opened, or the stricture divided outside the sac.

Erichsen, Hey, Ashton, Key, Luke, Druitt, Bryant and Holmes prefer division of the stricture outside the sac except where fear of mortified intestine or other special reasons forbid. Sir Astley Cooper preferred the extraperitoneal division in large old hernias, operated on early. Ashurst favors it in all cases where the taxis is justifiable. Gross and Birkett favor it in mild and recent cases, while Gant, Lawrence, J. F. Smith, Hamilton and Pirrie think that the sac should usually be opened, and the extraperitoneal division be reserved for exceptionally favorable cases.

Statistics have been gathered to decide the question, but I have not inserted them, because they are worthless. At first glance the extraperitoneal shows much less mortality than the other method; but the fact that the early cases only are selected for extraperitoneal division, shows that this operation is performed on much the safest class of patients, while the later cases, where there is risk that the gut may be mortified, compel the opening of the sac.

Late cases are always dangerous, whether there is mortification or not; hence, there is no proper basis of comparison. There are no reliable statistics of the two operations performed on patients of the same quality.

CONCLUSIONS.

Herniotomy is indicated whenever other means of relief fail, and should not be delayed a single hour unnecessarily. When there is strong reason to fear that the gut may be already mortified the taxis should be omitted for fear of returning a mortified intestine, and herniotomy should be

resorted to at once. Every hour of delay increases the danger.

If the strangulation is so recent and mild that it is morally certain that no mortification has yet occurred, the extraperitoneal division is the best, unless special circumstances forbid, for it diminishes the risk of peritonitis. The aspirator, of course, should never be used in a case deemed to be too far advanced toward mortification for prudent taxis, but it seems probable that in early stages it may be a valuable assistant to successful reduction, and experience has not yet developed any special dangers in its use.

OVARIOTOMY.

My records of this operation are mostly from Prof. Byford, and Dr. Dunlap, of Springfield, Ohio.

TABLE XVI.

CASES OF OVARIOTOMY PERFORMED BY PROF. W. H. BYFORD.

My first twenty-five operations were performed before the Great Fire, and the notes of them were burned up; the most I can say of them was that the proportion of recoveries was $66\frac{2}{3}$ per cent. One of these cases was in the Hospital for Women and Children, and recovered without any bad symptoms. My next thirteen cases are as follows:

AGE.	DURATION OF TUMOR.	SIZE AND DESCRIPTION OF TUMOR.	MARRIED OR SINGLE.	GENERAL CONDITION BEFORE OPERATION.	MODE OR PECULIARITY OF OPERATION.	RESULT.	TIME TO DEATH OR RECOVERY.	PRAC-TICE.
36	3 years	Wt. 37 lbs. Multilocular. Right ovary. Contents of main sac thick as jelly	Married.	Greatly impaired	Secured pedicle with ligature left in wound.	Recovered.	3 weeks	Private
31	14 months.	Multilocular. 28 lbs.	Married.	Greatly impaired	Right ovary seat of tumor; left diseased and remov'd	Recovered.	6 weeks	Hospit.
22	6 years	Two large tumors, one springing from each ovary. Weight, 28 lbs.	Single.	Greatly impaired	Both ovaries removed.	Recovered.	2 months	Private
42	7 months	Multilocular tumor, weighing 25 lbs. Left so diseased as to require removal. Weight, 37 lbs.	Single.	Greatly impaired	Both ovaries removed.	Recovered.	21 days	Private
31	9 months	Multilocular. 34 lbs.	Married.	Health poor		Recovered.	3 weeks	Private
23	1 year	Multilocular. 34 lbs.	Married.	Health good.		Recovered.	5 weeks	Private
36	7 years	Multilocular. 37 lbs.	Single. Very much impar	Very much impar		Recovered.	3 weeks	Private
18	18 months.	Multilocular. 37 lbs.	Single. Health good.	Health good.		Recovered.	14 days	Private
24	9 years	Dermoid cyst. 30 lbs.	Single. Very much impar	Very much impar		Recovered.	2 months	Private
24	17 months.	Multilocular. 30 lbs.	Married. Very much impar	Very much impar		Recovered.	2 weeks	Private
23	11 months.	Dermoid. 30 lbs.	Married. Good condition.	Good condition.		Recovered.	4 weeks	Private
27	13 years.	Multilocular. 45 lbs.	Married. Emaciated.	Emaciated.		Recovered.	6 weeks.	Private

In addition to the above I have accounts of 118 cases, of which 34 died, operated on by the following surgeons, viz.: Dr. Dunlap, of Springfield, Ohio, and Drs. E. Andrews, J. Andrews, D. Brainard, Brauns, A. Fisher, J. M. Hutchinson, A. R. Jackson and E. O. F. Roler.

RECAPITULATION.

AUTHORITIES.	CASES.	DIED.
Byford's operations before the great fire (notes burned up).....	25	8
Byford's operations since.....	13	2
Dunlap's operations.....	107	26
Other Lake State operators.....	11	8
Total Lake States cases.....	156	44

Mortality in the Lake States, 28 per cent.

OVARIOTOMY ABROAD.

AUTHORITIES.	CASES.	DIED.
W. L. Atlee, Philadelphia.....	350	105
Prof. Peaslee, N. Y.....	28	9
Dr. G. Kimball, of Lowell, Mass.....	203	67
Spencer Wells, of England, 1876.....	500	127
Dr. Clay, of Eng., quoted in Peaslee on Ov. Tum., p. 248.....	250	68
Dr. Keith of Scotland, " " " ".....	136	25
Thomas " " " ".....	27	9
Bradford " " " ".....	30	3
Dr. Clivever, of Boston.....	4	4
Bryant (Trans. Obst. Soc., London, 1865).....	10	4
Tyler Smith, " " " ".....	20	5
St. Thomas' Hosp.....	3	1
St. Bartholomew's Hosp.....	23	17
St. George's Hosp.....	5	4
Grimsdale, quoted Arch. klin. Chir. Bd. 8, S 813.....	10	3
Cases in Germany, Russia, Switzerland, Italy, Spain, Australia and India, Arch. klin. Chir. Bd. 8.....	35	15
K k allg Krankenhaus, Wien.....	25	17
Roosevelt Hosp.....	1	1
Totals.....	1660	484

Mortality, 29 per cent.

GENERAL SUMMARY.

	CASES.	DIED.	PER CENT. MORTALITY.
Lake States.....	156	44	28
Abroad.....	1660	484	29

OPINIONS OF AUTHORS.

In the treatment of ovarian cysts two operations have to be considered, viz.: Tapping and ovariectomy. On these points Prof. W. H. Byford, of Chicago, has favored me with the following opinions:

"TAPPING."

"Tapping an ovarian tumor is always attended with danger, and ought not to be resorted to without important reasons. This operation is especially hazardous in the polycystic variety.

"It is allowable in monocysts, when the diagnosis is doubtful, for the purpose of deciding the nature of the fluctuating mass.

"When the collection of fluid is very great and the patient in an exhausted condition, by evacuating it the patient will generally recruit under proper treatment. She will then bear ovariectomy better.

"If for any reason ovariectomy is impracticable, we may often palliate the suffering and prolong the life of the patient by tapping one or more times, as the case may require.

"Again, there is another condition, not very rare, in which tapping may be relied upon as curative, *i. e.*, when the vitality of the tumor is decreasing. This condition is more frequently observed in patients somewhat advanced in years, and is recognizable by what I would denominate tentative tapping, or the history of the case connected with this operation. If after several evacuations the length of time in which the tumor fills up is increasing, we may expect by repetition of the operations the vitality of the growth will be exhausted and eventually will not fill again. I have seen two remark-

able instances of this kind, in which the patients recovered after they had been tapped a number of times."

"INDICATIONS FOR OVARIOTOMY."

"We are justified in the performance of ovariectomy only when the patient's health is becoming impaired in consequence of the presence of the tumor. This will occur when it is large enough to press mischievously upon the vital organs. Of course other indications, under special circumstances, may determine the propriety of the operation, but it would not be expedient here to enter upon the consideration of them, as it would require too much space.

"Ovariectomy should not be thought of until the diagnosis is so clearly demonstrated as to leave no doubt in the mind of the operator."

Mr. Bryant, surgeon to Guy's hospital, thinks that tapping should be omitted in the majority of cases, unless needed for the purpose of diagnosis. Spencer Wells, however, whose vast experience gives weight to his opinion, thinks that previous tapping does not materially affect the safety of a subsequent ovariectomy.

Mr. Bryant thinks that ovariectomy should be performed in almost all cases of benign polycystic ovarian tumor, except when the patient's health is so broken down as to render it nearly certain that she will not bear the operation. As to the time to be selected he thinks ovariectomy should not be thought of until the health of the patient begins to suffer seriously from the growth of the tumor.

Jonathan Hutchinson discourages mere tapping, but speaks favorably of injections of iodine in the few unilocular cases. He favors ovariectomy strongly in proper cases, and reckons the risk at about 33 per cent.

Spencer Wells, and all the other great ovariectomists, of course favor the operation in proper cases, and it is scarcely worth while to quote against their decisive authority the crude objections of less experienced men in the earlier years of the discussion of this subject.

CONCLUSIONS.

The mortality of this operation, in the Lake States, has been 28 per cent. for all cases collected by me, but only 26 per cent. in the hands of Prof. Byford. Abroad the mortality has been 29 per cent., but grows somewhat less as skill and experience accumulate. The operation has been safer in Great Britain than on the continent of Europe.

It is a grave operation and never to be undertaken except after full investigation of each case, but there is no doubt that it is firmly established as one of the great operations of surgery. As remarked by Prof. Byford, it ought not to be performed until the patient's health begins to suffer from the pressure of the tumor, and a very careful investigation of all the conditions of the case should be made before decision; and then, if it is found that no insuperable obstacle exists, the operation is to be positively recommended, for after the tumor begins to interfere with the functions of vital organs, the short and miserable remnant of a life, without an operation, may rationally be risked for two chances out of three for a permanent cure.

With regard to tapping the tumor, nothing better can be said than the judicious words of Prof. Byford, quoted above under the head of "Opinions of Authors."

TRANSFUSION.

This operation has been performed in the Lake States but few times, so far as I can learn. The records are very imperfect, but some interesting observations have been made. Prof. Freer and Prof. E. Andrews have transfused for hæmorrhage in eight or ten cases. Prof. Freer's cases were the most numerous of the two, and one of them was so greatly improved as to give the highest hopes of recovery, when the patient suddenly died with symptoms of embolism. None of the cases of either operator finally recovered. Dr. Hotz transfused one case of hæmorrhage with lamb's blood, with the result of saving the patient. Dr. Hotz, together with Dr. Prægler and Dr. Wild, transfused, with lamb's blood, in eight cases of phthisis and anæmia. One was temporarily improved

and one died of the effects of the operation. Dr. Hotz is of the opinion that the operation should be limited to cases of recent hæmorrhage, but Prof. Freer is disposed to think that if Dr. H. had repeated the transfusion some of the failures might have been transformed into successes.

Prof. Freer has experimented largely on dogs, and from his observations concludes that the transfusion of defibrinated blood is the most successful plan.

Abroad the operation, if honestly quoted, has been more successful. Laudois gives 96 finished cases, of which only 31 died, being a mortality of 32 per cent.

The opinions of authors on this operation are generally expressed in rather vague terms, but for the most part they favor it for desperate hæmorrhage.

Gross, Freer, Ashurst, Moore, of England, Blundell and others favor it decidedly. Freer and Ashurst prefer defibrinated blood.

CONCLUSIONS.

The literature of transfusion is still in a very crude condition. My opinion is, however, that in cases of dangerous hæmorrhage it is an important resource, and that it is best performed with defibrinated blood. I think the ill success which has attended it in the Lake States is due to the reluctance of surgeons to undertake it promptly, and to the consequent fact that the patients were generally too far gone for recovery.

MISCELLANEOUS OPERATIONS IN THE LAKE STATES.

The following list contains a number of scattered cases recorded by myself and others worthy, perhaps, of notice, but not numerous enough to be tabulated in detail:

OPERATIONS.	CASES.	FAILED	DIED.
Trephining for frac of skull.....	10	0	3
“ for insanity after fracture.....	2	1	1
“ for idiopathic insanity.....	2	2	0
“ for epilepsy (permanency of successes not known).....	7	1	1
Ligation of common carotid artery for traumatic hæmorrhage.....	1	0	0
Ligation com. carotid for vascular tumor of orbit.....	1	0	0
Ligation of brachial art. for traumatic aneurism.....	1	0	0
Ligation of common iliac art. for aneurism of aorta.....	1	0	1
Ligation ext. iliac for traumatic aneurism.....	1	0	0
Ligation of ext. iliac for aneurism of femoral.....	1	0	0
Ligation of femoral for wounds.....	3	0	0
“ “ “ aneurism.....	2	1	0
Compression of arteries for aneurism*.....	6	4	
Stricture of urethra treated by internal section*.....	24	1	0
“ “ “ divulsion*.....	15	2	0
“ “ “ external perin sect.*.....	2	0	0
“ “ “ gradual dilatation*.....	50	0	0
Operations for hæmorrhoids*.....	45	0	0
Forcible rupture of ankylosis†.....	8	3	1
Operations for ununited fracture*.....	24	1	0
Stretching sciatic nerve for neuralgia (Nussbaum's operation).....	2	0	0
Neurotomy.....	8	0	0

* Records very imperfect.

† Three of the successes were imperfect.

For convenience of reference to those who wish to see at a glance what the experience of the world has been with regard to the principal operations, the following table is prepared:

TABLE XVII.

MORTALITY OF THE PRINCIPAL OPERATIONS.

CASES.	PER CENT. LAKE STATES	PER CT. ABROAD.
Amputation at shoulder joint, primary.....		35
“ “ “ second. and inter. comb.		48
“ “ “ pathological.....		29
“ “ “ average of all cases.....	30	39
“ arm, primary.....	20	27
“ “ intermediary and second. combin.		36
“ “ pathological.....		20
“ “ average of all cases.....	11	35
“ elbow joint, average of all cases.....		21
“ forearm, primary.....		11
“ “ intermediary.....		23
“ “ secondary.....		16

TABLE XVII.—Continued.

Amputation at forearm, pathological		22
“ “ average of all cases	10	16
“ wrist, primary		8
“ “ intermediary		14
“ “ secondary		20
“ “ pathological		7
“ “ average of all cases		18
“ hip joint, primary		99
“ “ intermediary		92
“ “ secondary		65
“ “ pathological		47
“ “ average of all cases*	43	30
“ upper 3d of thigh, primary	40	60
“ “ “ inter. and sec. comb'd		44
“ “ “ pathological		27
“ middle “ primary		48
“ “ “ inter. and sec. comb'd		59
“ “ “ pathological		22
“ lower “ primary	28	45
“ “ “ inter. and sec. comb'd		60
“ “ “ pathological		20
“ average of all thigh cases	24	62
“ knee joint, primary		48
“ “ “ intermediary and sec. comb'd		49
“ “ “ pathological		26
“ “ “ details not stated		54
“ leg, upper 3d, primary		36
“ “ “ intermed. and sec'y comb'd		47
“ “ “ pathological		31
“ “ “ average of all cases	36	37
“ “ middle “ primary		45
“ “ “ intermed. and secondary		44
“ “ “ pathological†		6
“ “ “ average of all cases	25	32
“ “ lower “ primary		37
“ “ “ intermed. and sec'y comb'd		29
“ “ “ pathological		16
“ “ average of all cases	13	
“ “ average of all times and locations	23	40
“ ankle, Syme's		9
“ “ Pirogoff's	22	18
“ foot, Chopart's		16
Resection, shoulder, primary		30
“ “ intermediary		46
“ “ intermed. and second. together		37
“ “ pathological		19
“ “ average of all cases		32
“ elbow, primary		22
“ “ intermediary		35
“ “ intermed. and second. combined		28
“ “ secondary, alone		9
“ “ pathological		12
“ wrist, average of all cases		19
“ hip, primary		92
“ “ intermediary		91

* This per cent. in the Lake States was derived from only seven cases. It cannot be expected to continue so low in the future.

† Derived from forty-nine cases. Mortality accidentally low

TABLE XVII.—Continued.

Resection, hip, intermed. and second. combined.....		71
“ “ secondary.....		85
“ “ pathological.....	42	46
“ knee, all traumatic combined.....		85
“ “ pathological.....	37	29
“ ankle, all traumatic combined.....		13
“ “ pathological.....	11	12
Herniotomy.....	24	49
Hernia, radical cure operations.....		4
Lithotomy, 1 to 5 years.....		7
“ 5 to 11 years.....		4
“ 11 to 16 years.....		11
“ 16 to 20 years.....		14
“ 20 to 30 years.....		13
“ 30 to 38 years.....		9
“ 38 to 48 years.....		17
“ 48 to 58 years.....		21
“ 58 to 70 years.....		27
“ 70 to 80 years.....		32
“ average under puberty.....		7
“ “ over “.....	38	19
“ “ all ages combined.....	23	16
Lithotriety.....		9
Tracheotomy and laryngotomy for diphtheria & croup,		
Under 2 years.....		100
2 to 3 years.....		73
3 to 4 years.....		68
4 to 5 years.....		76
5 to 6 years.....		65
6 to 7 years.....		55
7 to 8 years.....		76
8 to 14 years.....		58
All ages together.....	81	63
Tracheotomy and laryngotomy for œdema glottidis.....	25	26
“ “ for foreign bodies.....		25
Œsophagotomy.....		24
Ovariectomy.....	28	29
Transfusion for hæmorrhage.....		32
Ligation of the aorta.....		100
“ common iliac artery.....		76
“ internal “ “.....		58
“ external “ “.....		43
“ femoral “ “.....		34
“ profun. femoris “.....		62
“ popliteal “.....		76
“ arteries of leg and foot.....		50
“ innominata artery.....		94
“ common carotid “.....		45
“ internal “ “.....		12
“ subclavian “.....		55
“ axillary “.....		75
“ brachial “.....		19
“ radial and ulnar “.....		15
Trephining for fracture of cranium.....		50
“ for epilepsy.....		58
Colotomy.....		44
Gastrotoomy for stricture, foreign bodies, etc.....		58
Extraction of loose cartilages from the knee.....		20

I have in this unusually prolonged article endeavored to give a condensed view of the statistics and opinions of the world, on every principal operation in surgery. It has been a work of immense labor, but yet a very necessary one, for the contradictions of authors and the very frequent hastiness and superficiality displayed in writings of recognized authority render it almost impossible for the practical surgeon to distinguish truth from error.

I return my thanks to those gentlemen who have contributed their cases for the Lake States lists, and their names will be found in the tables.

I regret that the great Chicago fire swept out of existence the records of several excellent surgeons, thus depriving me of the benefit of their extensive experience; but the cases which I did obtain have been carefully sifted and fairly represent the results of surgery in this region.

CHICAGO, No. 6 Sixteenth St., Dec. 1, 1876.

COMPLIMENTS OF
THE AUTHOR.

Duplicate

THE
MORTALITY
OF
SURGICAL OPERATIONS
IN THE
UPPER LAKE STATES,
COMPARED WITH
THAT OF OTHER REGIONS.

By EDMUND ANDREWS, A. M., M. D.,
PROFESSOR OF PRINCIPLES AND PRACTICE OF SURGERY IN CHICAGO MEDICAL COLLEGE,

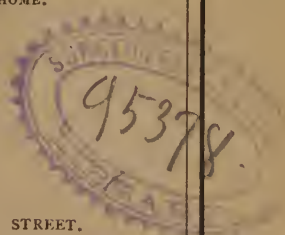
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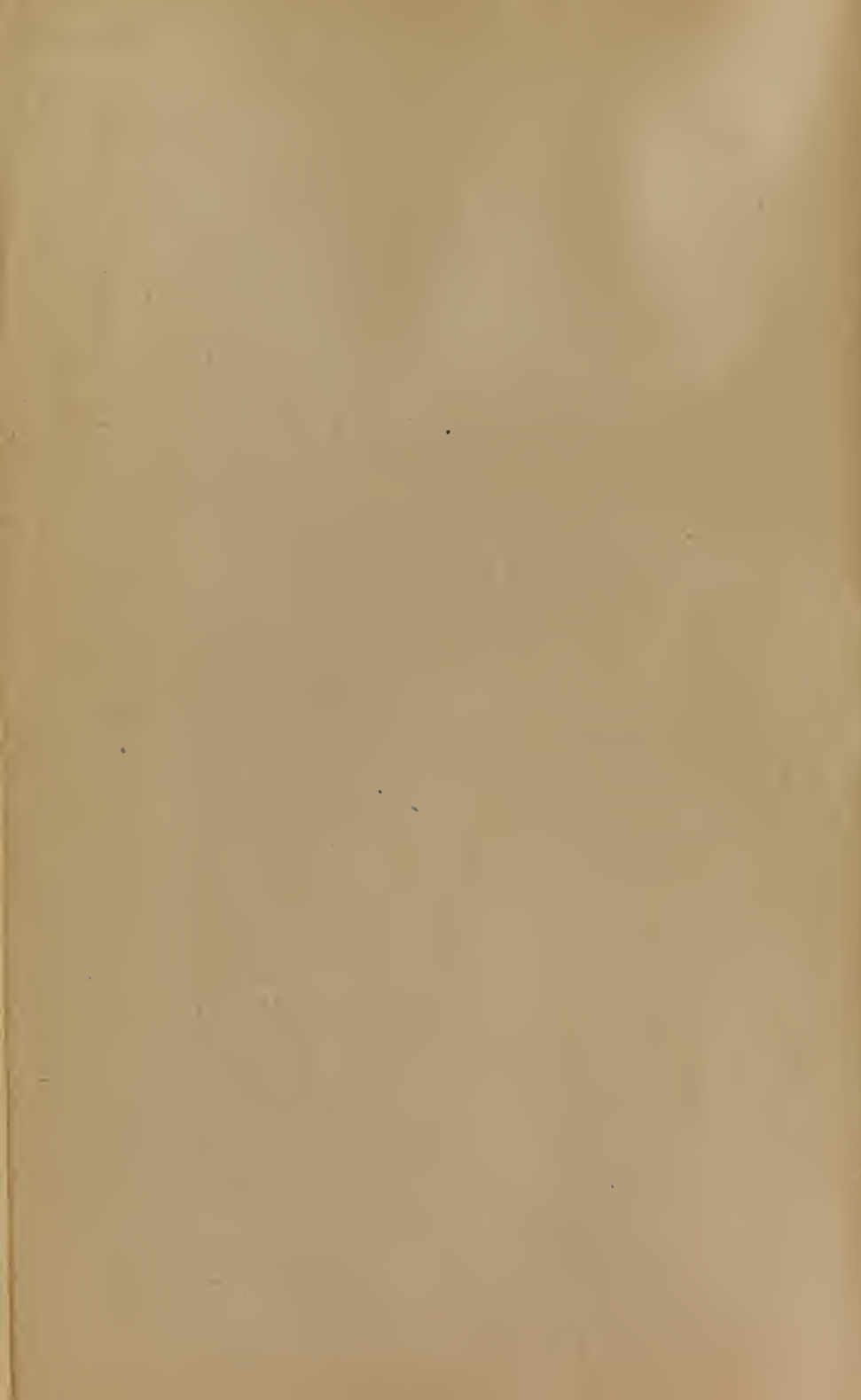
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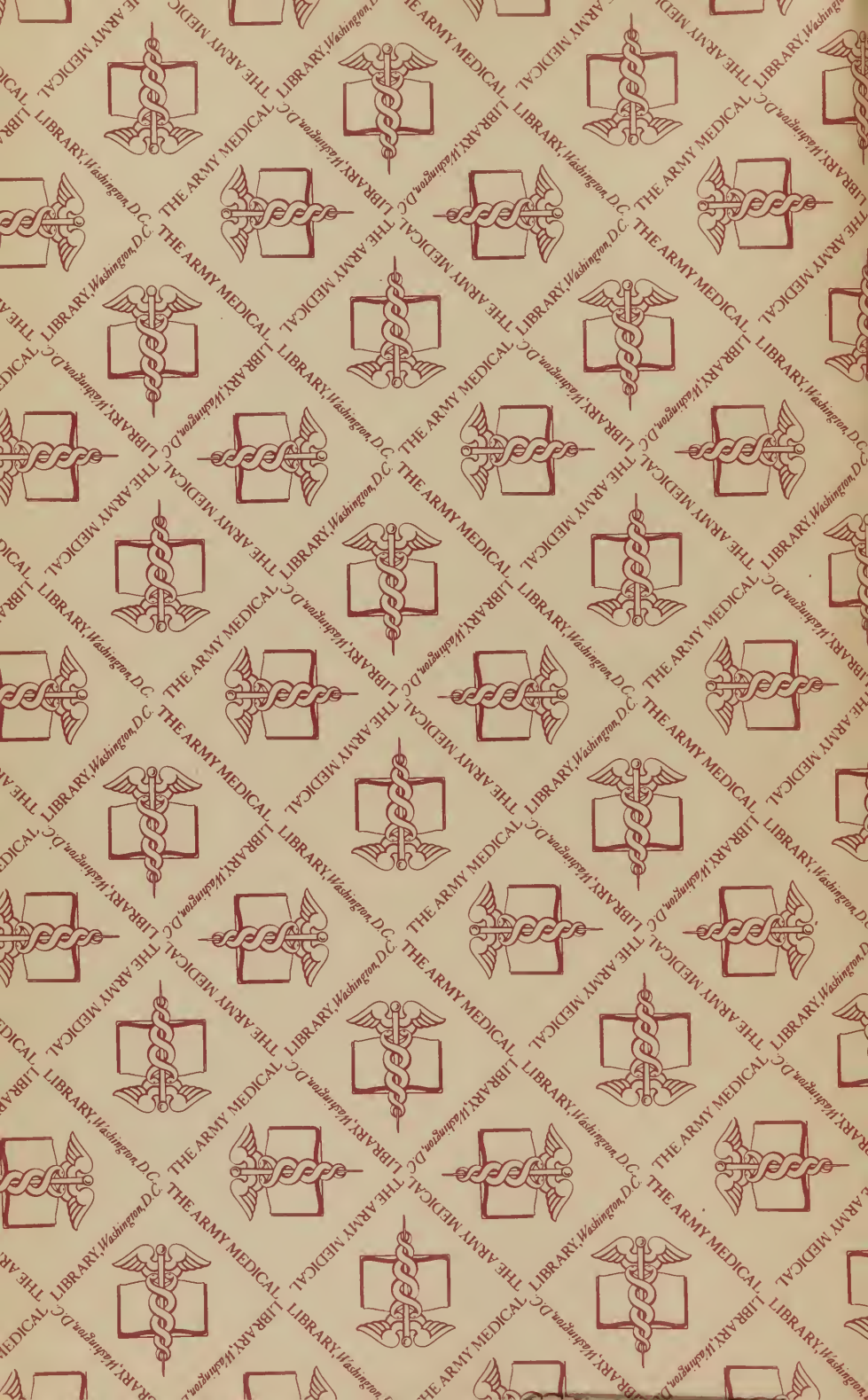
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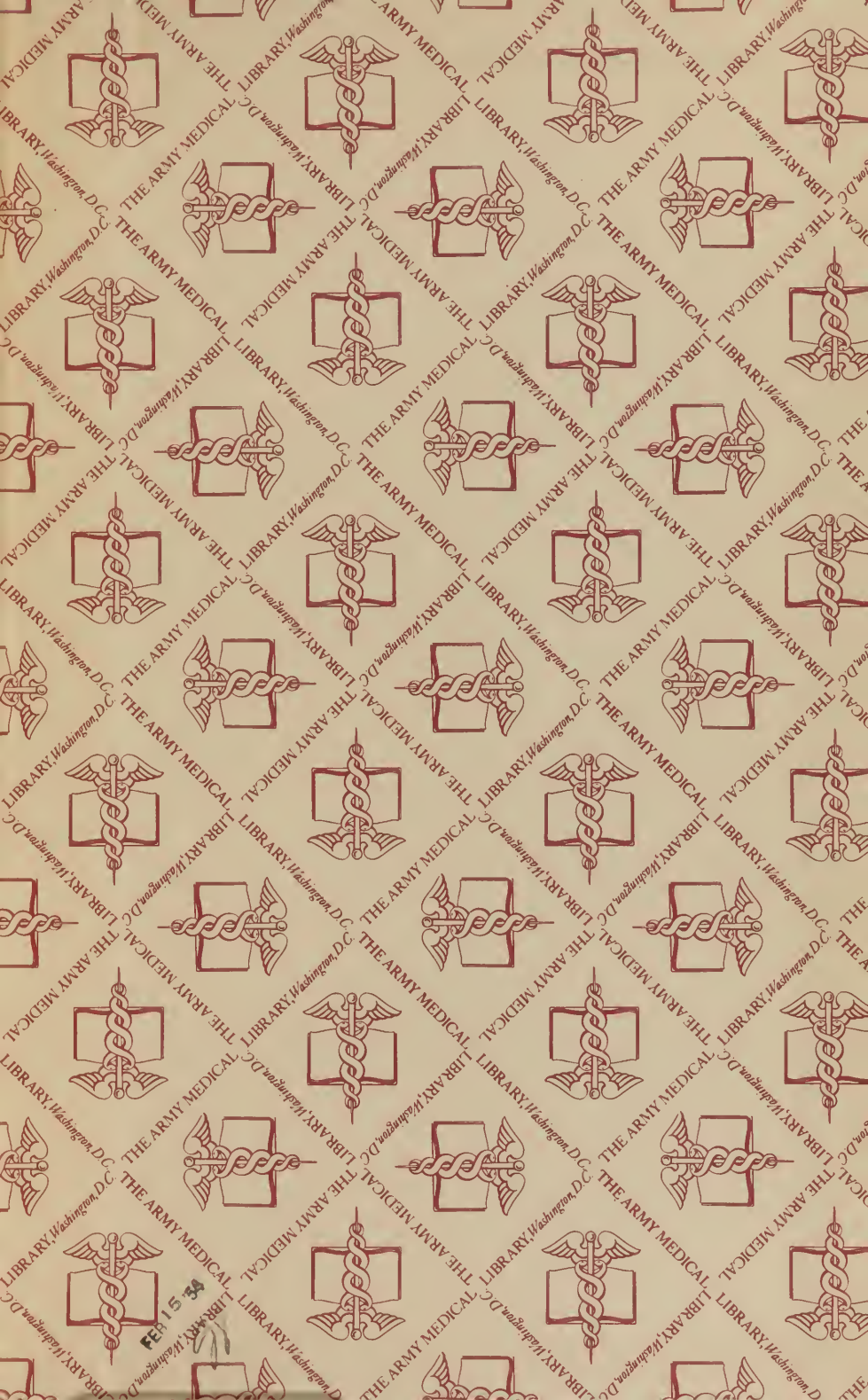
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